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SECTION OF THE ANTEROLATERAL COLUMNS OF THE SPINAL CORD FOR THE RELIEF OF PAIN

A REPORT OF SIX CASES *

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PHILADELPHIA

It is the surgeon's duty at times to perform operations conceded to be only palliative in effect, such as gastro-enterostomy for incurable gastric carcinoma, tracheotomy for a malignant lesion of the larynx, subtemporal decompression for inoperable tumors of the brain. When pain is a conspicuous feature, justification for operation is undeniable. I have, on more than one occasion, removed the gasserian ganglion for an inoperable tumor of the middle fossa. The suffering, attending lesions of the spine or spinal cord involving the posterior roots, is often beyond relief from opium or its derivatives and under such circumstances surgical measures may with propriety be considered. In 1912 Spiller proposed section of the anterolateral columns of the cord, when for one cause or another the patient is suffering from intractable pain. Since that time I have carried out this operation on six occasions; in four there was complete, and in two partial, relief.

Based on his studies of the location of pain fibers within the spinal column, Spiller [1] was led to the conclusion that fibers for the conduction of pain were located in the anterolateral columns of the cord, and it was on this observation that he proposed the operation under discussion. Grouped with the fibers that convey pain are those for temperature sense, so that it must be taken for granted that section of the anterolateral columns implies not only loss of pain, but also of thermal sense. The loss of perception of heat and cold in one or both hands might be regarded as serious and might be advanced as an argument against the operation in question. As the section of the column would not, under any circumstances, be made high enough to include the brachial plexus, this objection is not to the point. Loss of thermal perception in the trunk and lower extremity is relatively unimportant and would gladly be exchanged for pain by the patient.

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* Read at the Forty-Sixth Annual Meeting of the American Neurological Association, June, 1920.

1. Spiller: Univ. Penn. M. Bull., July and August, 1905.

The anterolateral column cannot be sectioned without including Gower's tract, and one might question whether objective disturbance of sensation would follow the operation, either as a temporary or persistent sequel. The character of the cases on which we operated, the presence, in some before operation, of disturbances of sensation, prevented enlightening observations on this point, save in one case, and in this tactile sensation was preserved throughout where pain and thermal sensation were absent.

In this connection I recall the experiments of Cadwalader and Sweet,[2] who, after section of the anterolateral columns in dogs, noted in addition to the loss of cutaneous sensations for pain and heat, a pronounced ataxia. This ataxia was attributed to injury to Gower's tract, and Cadwalader looked on this as a pseudoparalytic rather than a true paralytic ataxia, as part of profound disarrangement of the pseudomuscular apparatus. The sensory impression that should pass through Gower's tract had been cut off and, as the compensatory function of the remaining sensory tracts was being established, the pseudoparalysis gradually disappeared. Very briefly, these are what might be called the theoretical considerations. Let us now review their practical application.

My experience with this operation includes a series of six cases, in three of which the source of pain was a malignant lesion, and in three gunshot wounds of the spinal cord or lumbosacral plexus.

REPORT OF CASES

CASE 1.—*Summary.*—The patient had an inoperable sarcoma of the spine at the level of the second and third lumbar vertebrae. Suffering was intense and uncontrolled by morphin. Chordotomy was employed with section of the anterolateral columns, right and left, at the level of the first lumbar segment. This resulted in total loss of thermal and pain sensation.

History.—M. B., aged 31 (File No. 33336), was admitted to the University Hospital Aug. 25, 1916. Seven months before the patient began to complain of pain in the left knee and three weeks later of pain in the right knee. Later he experienced pain across the lower end of the sacrum and severe burning sensations from the tuberosity of the ischium to the knee. When admitted to the hospital he had edema of both feet, and there was almost complete paralysis of the left and partial paralysis of the right lower extremity. The tendon reflexes of both extremities were abolished. There was no disturbance of tactile, pain or temperature sense. The patient complained bitterly of burning pain, starting at the hips and radiating to the knees and of cramp-like pain in the calves.

Exploratory Laminectomy, Oct. 7, 1916.—The spinous processes of the first, second and third lumbar vertebrae were removed. At the level of the third

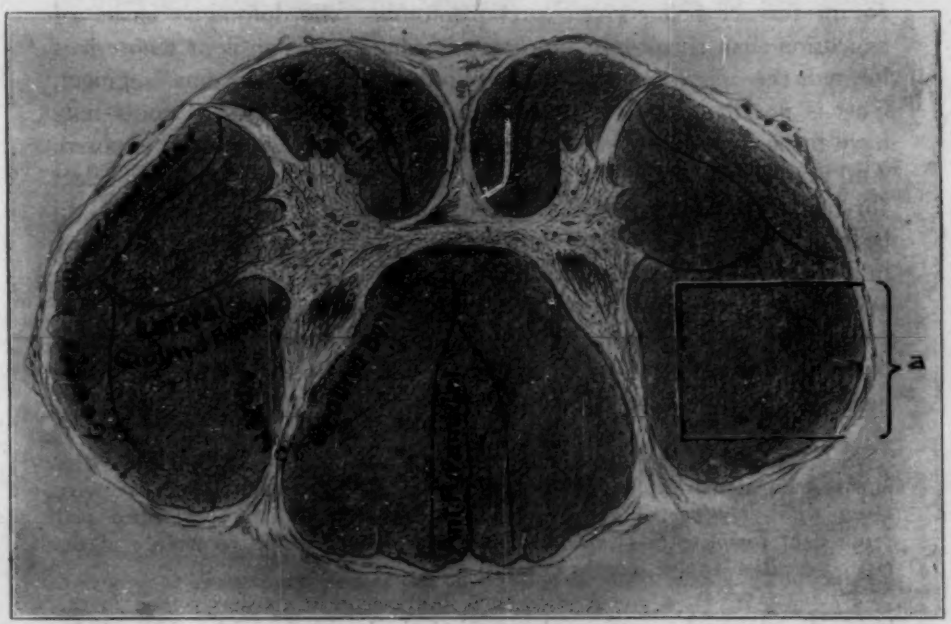
2. Cadwalader, W. B., and Sweet, J. E.: Experimental Work on the Function of the Anterolateral Column of the Spinal Cord, J. A. M. A. **58**:1490 (May 18) 1912.

lumbar lamina a large cavity was discovered, extending up and down the left side of the vertebral canal, containing a mass of tumor tissue. It was evident from its nature and extent that the tumor was inoperable.

Pathologic Report.—A small round cell sarcoma was found.

The insufferable pain continued, it was uncontrolled by morphin, and for its relief it was decided to do a chordotomy. Before the operation an examination was made of the disturbance of sensation in the lower extremities.

Chordotomy, Nov. 11, 1916.—Ether anesthesia was used. The spinous processes and laminae of the ninth and tenth thoracic vertebrae were removed. A pledget of cotton, saturated with 0.4 per cent. stovain, was applied to the surface of the cord and roots above the level of the section (stovain block). The cord



The spinal cord at the level of the sixth thoracic segment. Cutting the anterolateral columns of the cord, as described, implies section of that portion of the cord included in the area marked *a*.

was rotated by traction on the denticulate ligament. The anterolateral column was sectioned 3 mm. by 2.5 mm., first on the left then on the right side. The wound was closed with tier sutures.

Nov. 16, 1916: Five days after the operation, an examination of sensory disturbance revealed practically complete loss of pain and thermal sensation in the area below that supplied by the first lumbar segment.

Eleven days after the operation the patient's condition had much improved, he was able to sit in a wheel chair, whereas before the operation he was bedridden and his condition pitiable.

Six weeks after the operation the patient was discharged from the hospital. He had continued free from pain.

Commentary.—I know of no other conditions in which the pain is more intense than in malignant tumors of the vertebral column, whether in sarcomas or carcinomas. The invasion of the posterior roots by the tumor, as the source of pain, suggests the possibility of relief by a rhizotomy or division of the posterior roots. As a matter of fact, on several occasions I have resorted to this method. But section of the anterolateral columns is, I think, to be preferred to rhizotomy. As a theoretical objection to rhizotomy in inoperable tumors of the vertebrae one has but to consider the likelihood of return of pain, as the tumor increases in size and invades the roots above or below those divided at the operation. There is another reason, I think, for preference being given to chordotomy — chordotomy is easier of execution than rhizotomy. No matter what the lesion is or where it is located, the operation implies the exposure of but one spinal segment. This is not the case with rhizotomy, in which a series of roots may have to be divided and a corresponding number of segments exposed. And then no matter where the lesion is located the operator may select for his own convenience the segment at which the cord section is to be made. Latterly, I have chosen the sixth cervical segment as being in a region of the vertebral column at the apex of its normal convexity and where it is the more readily accessible. It is a matter of no little consequence that in an operation de complaisance the operation should be stripped of all technical difficulties and thus freed from risks. There have been no fatalities in our series.

CASE 2.—*Summary.*—The patient had a gunshot wound of the spine with intense pain in the left lower extremity. Four grains of morphin a day were given with only partial relief. Unilateral chordotomy was performed and resulted in complete cessation of pain. There had been no recurrence at the last observation twelve months later.

History.—W. P., a young man, aged 21, received a gunshot wound in the lower dorsal vertebrae. Several months had elapsed from the time of the accident until he came under the writer's observation. At that time he had a complete paraplegia and was suffering day and night from pain which radiated down the left thigh. To control the pain, hypodermics of morphin, as circumstances might require, were prescribed. As 4 grains in the twenty-four hours gave only partial relief, operation seemed justifiable.

Dec. 12, 1918: Chordotomy was performed; also laminectomy of the fifth and sixth thoracic vertebrae, and section of the anterolateral columns at the level of the sixth cervical segment. The wound was closed with tier sutures.

Postoperative Course.—The convalescence was uneventful. The results were brilliant. The patient was given one hypodermic the night of the operation and after that none. The pain disappeared, and when last seen, twelve months later, there had been no recurrence.

Commentary.—The indications for some radical measure to relieve pain were in this case commanding. The patient was in a state of

demoralization and exhaustion from suffering day and night. He was confined to bed because body movement excited pain. Although given morphin freely and in increasing doses he was afforded only a measure of relief. The immediate withdrawal of morphin after operation from a patient addicted to large doses, was a striking and assuring demonstration of freedom from pain. The patient gained in weight, he was soon able to go about in a wheel chair, and he was transferred from a person in abject misery to a reasonably cheerful creature, despite his other disabilities.

CASE 3.—*Summary.*—The patient had carcinoma of the rectum, with pain in the rectum, buttock and thighs. Colostomy and section of the anterolateral column, left and right, were performed. Complete loss of thermal and pain sense on one side only resulted. Radium therapy was employed for the carcinoma. Four years later the patient reported himself as free from discomfort; presumptive recovery.

History.—L. W. G., a man, aged 44 (File No. 32063), was admitted to the University Hospital May 24, 1916. His case was diagnosed as carcinoma of the rectum. A large mass, just above the anal canal, filled the lumen of the bowel. The condition was inoperable.

Treatment and Course.—May 25, 1916: Colostomy through the left rectus muscle, under local anesthesia, was performed.

June 1 and June 21: Ninety mg. of radium were applied for twenty-four hours. On June 23 he was discharged from the hospital. His general condition had improved, The colostomy was functionating well. He continued to complain of pain in the rectum, perineum and legs.

Sept. 22 and Nov. 23, 1916: The patient was readmitted to the hospital for radium therapy. His condition was one of demoralization. He was complaining bitterly of pain in the rectum, perineum and thighs. Large doses of morphin gave only partial relief.

Jan. 18, 1917: Chordotomy was performed under nitrous oxid anesthesia. The spinous processes of the ninth and tenth thoracic vertebrae were removed. Section was made of the anterolateral column on the left side. The cataract knife entered the cord 2.5 mm. posterior to the point at which the anterior root leaves the cord, and section of the cord was made from this point forward 2.5 mm. and 2.5 mm. deep. The anesthetic was discontinued and an attempt was made to test sensation, but the patient was too disturbed and restless. The anesthesia was resumed and preparations made to section the anterolateral column on the right side. Section of the anterolateral column on the left side seemed to be in accordance with the prescribed measurements, but on the right side it was the opinion of the operator that the section was not liberal enough.

Jan. 25, 1917: One week after operation there was a flaccid paralysis of the left lower extremity, and both the patella tendon and Achilles tendon reflexes were diminished. There was no motor disturbance of the right lower extremity and the reflexes were normal. The patient complained of bearing down pain in the bladder.

Feb. 2, 1917: A physical examination was made which revealed: Right lower extremity: There was preservation of tactile sensation throughout and loss of thermal and pain sensation over the buttock, perineum, posterior aspect of the thigh and below the level of the knee. There was no disturbance of

sense of position. Movements of the limb were unimpaired. The patella and Achilles' tendon and cremasteric reflexes were normal. There were abortive ankle clonus and dorsiflexion of the great toe.

Left Lower Extremity: The patient could distinguish between hot and cold and the prick of a pin throughout the extremity. The sense of touch was preserved, although the patient stated that sensation was not so acute in the anterior and lateral surfaces of the thigh. There was no disturbance in the sense of position. All movements of the left lower extremity, temporarily arrested after the operation, have been restored. Achilles and patella tendon reflexes were more active than at the last examination, January 25. Ankle clonus and the Babinski reflexes were present. The patient continued to have attacks of vesical tenesmus, but they were not so frequent or so painful as formerly.

April 21, 1917: The patient was discharged. There had been no change in the sensory disturbances as noted Feb. 2, 1917. Several attempts were made to have the patient return for continued radium treatments, but without success. During the war he was lost sight of.

Sept. 10, 1919: The patient writes "I do not feel any soreness in the perineum or rectum. I ride a bicycle a great deal without discomfort. My appetite and digestion are good, and my limbs are strong."

May 23, 1920: Four years after the patient came under observation his condition was reported through a verbal communication as satisfactory.

Commentary.—This is an extremely interesting case from many points of view. Too often we relegate to the scrap heap patients with apparently incurable lesions. Nothing could have appeared so utterly hopeless as this huge rectal carcinoma. Four years have elapsed since treatment was instituted and the patient once bedridden, is up and at work. The peculiar susceptibility of rectal carcinoma to radium therapy is, of course, well known, but the symptoms, when the patient was first seen, were at least suggestive of extension of the tumor beyond its original site. I am reminded, in speaking of seemingly hopeless cases, of a case of inoperable sarcoma of the spine. To relieve pain I divided a series of posterior roots and instituted roentgen-ray treatment and injections of Coley's fluid. Three years and three months have elapsed since the operation, and when the last roentgen-ray treatment was made the tumor shadow had entirely disappeared. Returning to the case of rectal carcinoma, it was evident that one side of the anterolateral column was not entirely divided, at least not sufficiently, since perception of pin prick and heat and cold in the left lower extremity were not abolished altogether, as they were in the right lower extremity. As commented on elsewhere, there is, of course, a possibility of error on the part of the operator in including the prescribed amount of tissue in this section.

CASE 4.—*Summary.*—The patient had an inoperable sarcoma of the thigh with pelvic metastasis and insufferable pain in the gluteal region. The anterolateral columns of the cord were sectioned with relief from pain from the time of the operation until the patient's death, months later.

History.—T. C., a man, aged 39 (File No. 38089), was admitted to the University Hospital Dec. 22, 1918. In August, 1916, he noticed a sharp pain in the thigh. The latter increased in size and a diagnosis of sarcoma was made. Two operations were performed for the removal of the growth by Dr. J. H. Page, Austin, Pa., Aug. 28 and Oct. 3, 1917. One month later there was evidence of recurrence.

Examination.—Examination on admission revealed a tremendous infiltrating diffuse tumor of the right thigh, edema of the leg, dilatation of the superficial veins and enlargement of the inguinal lymph nodes.

Pathologic Report.—The pathologic report of tissue removed for examination stated that perithelial small round cell sarcoma had been found.

Treatment and Course.—Treatment with Coley's fluid and radium was instituted. The patient complained bitterly of pain referred chiefly to the gluteal region, and while the lesion was inoperable, the distress of the patient justified some attempt to relieve the pain.

Jan. 30, 1918: Chordotomy was performed and spinous processes and laminae of the seventh and eighth thoracic vertebrae were removed. The denticulate ligament was grasped with mosquito forceps, the cord rotated and, with a sharp curved needle, armed with fine silk, the anterolateral column was encircled, and with the cord thus fixed the column was divided with a cataract knife.

Postoperative Course.—The patient made an uneventful recovery. He was entirely relieved of pain and continued free from pain until his death several months later.

Commentary.—The condition of the patient, in the judgment of the operator, justified some radical means of relief. The propriety of any operation under conditions in which the expectation of life is brief, might be questioned, but I should have no hesitancy under similar circumstances in recommending a chordotomy, especially as no risk is entailed and it assures the patient an extraordinary measure of relief from pain for the months that remain to him.

CASE 5.—*Summary.*—The patient had received a gunshot wound of the spine, and suffered pain in both lower extremities. Chordotomy was performed with loss of pain and temperature sense.

History.—H. G., a man, was operated on at a U. S. Army General Hospital, March 3, 1919. The patient was injured overseas, and complained of shooting pains in both lower extremities. These were of such severity as to justify an attempt at relief by operation.

March 3, 1919, a chordotomy was performed. The sixth thoracic segment was uncovered by removing the laminae of the fifth and sixth thoracic vertebrae. Immediately after section of both anterolateral columns sensation was tested by Dr. Cobb and there was complete loss of pain and temperature sense up to the level of the umbilicus on both sides. The patient survived the operation.

(The clinical record of the subsequent course is not available.)

CASE 6.—*Summary.*—The patient had received a shell wound of the pelvis with injury to the sciatic nerve. He had had intense unbearable pain in the thigh and foot for two and a half years, unrelieved and unabated. The anterolateral columns were sectioned with absolute relief. There was recurrence of pain, much more moderate, several months later.

History.—H. E. H. D., a man, aged 50 (File No. 58567), was admitted to the University Hospital May 12, 1919, under the care of Dr. W. G. Spiller. He had been wounded in France, Oct. 21, 1916, by a high explosive shell which penetrated the pelvis on the right side below the crest of the ilium. Five weeks after the injury he began to complain of pain in the right leg, radiating down the course of the sciatic nerve to the foot. The pain in the right foot never ceased; it was worse at night, and was shooting and burning in character. The pain in the thigh was of like character, and began about 12 inches above the knee and extended 3 inches above the midpopliteal space.

The patient in walking was unable to put the right foot to the ground and always used crutches.

Examination.—May 14, 1919: Touch, pain and thermal sensations were lost in the right sciatic distribution. In the popliteal space on the inner side of the leg and on the inner side of the sole of the foot there appeared to be some sensation, probably from the overlapping of adjacent nerve territories. The right calf and right thigh were much wasted. He could flex the right leg at the knee to a right angle with fair amount of power, but resistance to passive movement showed great weakness in the flexors of the leg on the thigh. He had a little dorsal and plantar flexion of the right foot. The sole and heel showed evidences of trophic disturbance in the thickening and desquamation of the skin. The patellar reflex was about normal on the left side, and was present but diminished on the right. The Achilles tendon reflex was normal on the left, but absent on the right side. Frequent involuntary jerking of the right lower limb followed twinges of pain (Spiller).

Roentgen-Ray Examination.—The shell evidently injured the upper portion of the ilium and the transverse process of the fifth lumbar vertebra. There was evidence of a preexisting osteomyelitis in the projections of bone which indicated calcification along healed sinuses. The lesion was evidently outside the vertebral column.

Operation, Treatment and Course.—A chordotomy operation was performed by Dr. C. H. Frazier, May 24, 1919. The spinous processes and the laminae of the sixth and seventh thoracic vertebrae were removed. Rotation of cord was accomplished by traction on denticulate ligament. One anterolateral column of the cord was sectioned. Closure of the dural incision was made with continuous silk suture. The wound was closed with tier sutures.

Postoperative Examination, June 10, 1919: Sixteen days after operation the following notes were recorded by Dr. Spiller:

"Tactile, heat and cold and pain sensations are greatly impaired down the back of the thigh, the outer side of the leg beginning about the union of the upper with the middle third, in the dorsum and sole of the right foot except at the inner margin. Cold sensation is sometimes called hot and is always recognized in an uncertain manner on the inner side of the right leg, front and sides of the right thigh and right side of the abdomen, about one or two inches above the umbilicus. Here the impairment of temperature sensation shades off gradually into the normal area. This impairment of temperature sensation is pronounced in the right lower limb but never amounts to a complete loss. Pain sensation is diminished in the right lower limb and right lower abdomen, as is temperature reaction. A moderate prick of the pin which would be recognized promptly in the left side is often called dull. There is therefore a positive diminution in pain sensation in the right lower limb, which never amounts to a complete loss.

"Localization of touch is as good or nearly as good in the right lower limb as in the left. The toes of the right foot are so rigid from the result of an old injury to the foot that sense of position cannot be properly tested.

"He still has paresthesias which he describes as if the part were asleep. This is confined entirely to the sole of the right foot. It is probable that this paresthesia is the result of the old injury to the nerves of the foot and is not the result of the recent operation. The pain of the right foot was so intense before the recent operation that it probably obscured any paresthesia that might have been present."

From the time of the operation to the patient's discharge from the hospital, June 19, 1919, the patient was practically free from pain. This was the first time he had enjoyed any relief since the onset of pain two and a half years ago. July 4, 1919, after a trip cross the continent, the patient wrote: "I stood the trip very well and feel that I have taken a new lease of life. Since the operation or a day or so after, I have had no pain at all, although I have a peculiar sensation in my foot most of the time. This I described to Dr. Spiller, and is perhaps more noticeable now probably because *I am using my foot a good deal. However, this is not a pain and really bothers me very little.*"

Jan. 8, 1920, word was received that during the past three months there had been a return of pain, but it was reported to be not nearly as severe as before the operation.

Commentary.—This was unquestionably a case in which a chordotomy was indicated. The pain was unbearable and the patient was in great distress for two and a half years. The nature of the lesion was conjectural, possibly a nerve compression or neuroma, but the location of the lesion within the pelvis was such as to make it difficult of approach and it was doubtful whether a nerve liberation would have given relief. At all events, after explaining to the patient the difficulty attending an operation, designed to explore the lesion, and presenting the alternative proposal, a chordotomy, he chose the latter.

The immediate and complete relief which followed the operation was a practical demonstration of what may be expected when the anterolateral column is divided. That there should have been recurrence of pain, though not in its original severity, illustrates the only difficult problem in the performance of the operation. It is, of course, difficult to make the section of the cord according to prescribed measurements. The anterolateral column is estimated as 2.5 mm. in width and depth. To make the section with mathematical precision and without injury to adjacent structures is not an easy matter, but I believe with the introduction of instruments particularly designed for this purpose, fewer errors will be made, and the percentage of complete and permanent recoveries will be higher. The operation is founded on sound physiologic principles, and it remains only to overcome this technical difficulty.

CONSIDERATIONS OF TECHNIC

The success or failure of this operation is wholly dependent on the accuracy with which the operator follows his instructions. There

are two points to be considered: 1. At what level shall the section of the anterolateral column be made? 2. How shall the section be made?

By way of preface it may be said that the cord should be exposed by the removal of the spinous processes and the laminae of two vertebrae. At least two spinous processes should be removed, and I think it is better to remove two rather than one lamina. One needs amplitude of exposure in all intraspinal procedures, and for this reason I disapprove of unilateral laminectomy. The removal of but half the arch does not give sufficient exposure and has no merits whatsoever.

1. The question of segmental selection is a matter of some consideration. We assume that the lesion does not involve the upper extremity. Manifestly, the section could not be made sufficiently high, that is, several segments above the origin of the brachial plexus, with any degree of safety. We assume that the lesion is in the pelvis or involves the spinal column not above the upper thoracic vertebrae. With this understanding, a general rule might be laid down that the section should be made at least four segments above the lesion so as to ensure the crossing of all afferent tracts and to allow for the extension of the growth upward — it would be well to add two or three segments. So much for the physiologic or anatomic grounds. From the practical or technical point of view, I have selected the sixth thoracic segment as the most convenient for all lesions not higher than the ninth or tenth segments. (As a matter of fact, in all my cases, the lesion has been below this level.) The fifth and sixth thoracic vertebrae or their spinous processes are near the apex of the normal convexity of the spinal column and the spinal cord at this level is nearer the body surface and therefore more accessible. For this reason let us consider that the sixth thoracic segment is the site of election.

2. To answer the question—How shall the section be made?—we must recall the topographical relationship of the columns in the lateral aspect of the cord between the points at which the anterior and posterior roots are given off. If we should divide the distance between the posterior and anterior roots in two, that area of the cord dorsal to the dividing line contains the direct cerebellar and lateral pyramidal tracts; that ventral to this line contains the lateral and anterolateral tracts and Gower's tract. It is this area of the cord with which we are chiefly concerned.

To include the anterolateral tract in the section, it is necessary of course to sacrifice Gower's tract, but from such observations as we have been able to make, this does not lead to impairment of tactile sensation. The crux of the situation is this: How wide and how deep must the section be made? As to width, the posterior boundary would be represented by a point midway between the anterior and posterior

roots. In the past we have divided the tissue between this point and the anterior root, but Spiller is disposed to believe that one could include with propriety the anterior root in order to assure division of the entire tract. This, I think, is an excellent suggestion, since one anterior root at this level might be sacrificed with impunity. Of greater difficulty is the determination as to depth. The estimated distance from the surface of the cord to, and including, the anterolateral column is 2.5 mm., but in some of our cases there has not been total loss of pain and thermal sense. Whether this was due to inaccurate execution at the operation, or to underestimation of the dimensions of the column is a matter for discussion. I am inclined to attribute our failures to the former rather than to the latter, since in some instances there has been total loss of thermal and pain sense when the knife penetrated the cord the prescribed distance, i. e., 2.5 mm.

A word might be said in conclusion as to the operative technic. After exposure of the cord at the selected level, the cord must be rotated by grasping a denticulate ligament with mosquito forceps. This brings into view the anterolateral area. To section the latter, according to prescribed measurements, a special instrument should be used. The instrument I recommend is one in which a blade, with a curve 2.5 mm. in diameter, is mounted on a carrier at an obtuse angle. With this the anterolateral column is encircled and a second sliding blade is advanced until the tissue intervening between the two blades is severed. This instrument as nearly as possible assures an accurate performance of the operation.

THE RELATION OF THE CEREBRAL HEMISPHERES TO ARTERIAL BLOOD PRESSURE AND BODY TEMPERATURE REGULATION

PRELIMINARY NOTE *

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It has been pointed out elsewhere [1] that removal of the cerebral hemispheres and the optic thalamus destroys the mechanism for regulating body temperature and reduces the animal to a cold-blooded condition. This loss of ability to maintain a normal body temperature after extensive traumatic injury around the third ventricle is common to all warm-blooded animals from man to birds. Only one group of warm-blooded animals so far as the literature indicates will long survive such an operation. Dogs, cats and monkeys may be kept alive for several days, but in the dog, on which most work has been done, one week is the maximum recorded length of life. In birds, which are warm-blooded animals, with proper precautions the animal may be kept alive for several months.

In an attempt to analyze the factors that lead to this loss of ability to regulate body temperature, studies on the circulation of the blood in these animals have been started. A method was devised for measuring arterial pressure in the pigeon and determinations have been made before and after reduction of the animal to the cold-blooded condition.

In the normal adult pigeon under all stages of ether anesthesia the blood pressure in twenty-three birds ranged between the extreme limits of 98 to 180 mm. of mercury. The average value of these determinations was 121 mm. (Table 1).

Measurements of arterial pressure have been made on six pigeons reduced to the poikilothermous condition by removal of the thalamus and hemispheres. These have been made at time intervals of from three to thirty days after operation so as to exclude the possibility of dealing with the acute effects only. The body temperature of these birds was set at various levels by changing the temperature of the incubator in which they were kept. The results of this experiment are given in Table 2.

These results suggested that the loss of temperature regulation was the result of lowered arterial pressure. However, as a control on this

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* From the Hull Laboratory of Physiology, University of Chicago.

1. Am. J. Physiol. **49**:271, 1919.

TABLE 1.—Arterial Pressure of Normal Birds*

126	114	108
106	100	122
142	124	136
138	124	124
116	118	122
160	102	98
110	119	110
150	110	

Average, 121.

* All readings are made in mm. of mercury.

TABLE 2.—Arterial Pressure of Poikilothermous Birds

Days to Recover from Operation	Body Temperature	Blood Pressure
3	29 C.	78 mm.
5	28 C.	84 mm.
13	28 C.	95 mm.
5	36 C.	104 mm.
15	29 C.	93 mm.
29	41 C.	85 mm.
3	31 C.	80 mm.

TABLE 3.—Arterial Pressure of Decerebrate Birds; Body Temperature Normal

Normal Pressure Before Operation	Days to Recover from Operation	Blood Pressure After Operation
128 mm.	8	105 mm.
156 mm.	11	97 mm.
108 mm.	3	93 mm.
98 mm.	16	96 mm.
134 mm.	3	98 mm.
142 mm.	5	122 mm.
124 mm.	5	103 mm.
...	75	105 mm.
...	21	96 mm.
...	6	87 mm.
...	11	91 mm.

conclusion, blood pressure readings were made on birds from which the hemispheres only had been removed, the thalamus being left intact, and which therefore had normal body temperature. It was found that loss of the hemispheres also led to a similar fall in arterial pressure, though not quite so extensive (Table 3). In different cases this ranged from 10 to 20 per cent. It has long been known that in acute experiments removal of the hemispheres leads to a slight fall in arterial pressure, but as is evident from the time figures given, this fall is more than a mere temporary shock effect, and may persist as long as two and one-half months after decerebration; and this occurs in animals in which we have been accustomed to think the shock effects are at a minimum.

A comparison of the arterial pressure in the two sets of operated birds, both with hemispheres removed, the one with the ability to regulate body temperature, and the other with temperature regulation impaired, indicates a greater degree of depression in the latter series. However, the difference is so slight that it suggests that the lowering of body temperature must be due to some other factor than that of circulatory disturbance alone. I suspect that the disturbance in body temperature is due not only to the vascular disturbance, but also to lessened heat production, in part if not wholly due to injury of the subcortical motor centers for the skeletal muscles.

In concluding, it may be added that the above described effects are inconstant in localized lesions of either the hemispheres or thalamus. Hence the effects described are, in this report, confined to those following total extirpation. Certain effects of lesser lesions will be described in the full report to be given later.

SUMMARY

Removal of the cerebral hemispheres in the pigeon, leaving the thalamus intact and body temperature normal, leads to a constant fall in arterial pressure of from 10 to 20 per cent. This fall comes on immediately and persists for as long as seventy-five days after the operation.

Removal of the hemispheres and thalamus leads to a loss of temperature regulation and usually to a slightly greater fall in arterial pressure than does loss of the hemispheres alone.

The poikilothermous condition that follows deep lesions of the brain stem is not due to changes in the arterial blood pressure alone.

ABSENCE OF LOBUS OLFACTORIUS AND SCLEROSIS OF CORNU AMMONIS*

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Cases showing absence of the olfactory lobe are rare. In 1914 Weidenreich[1] reported one case and quoted nine others from the literature on this subject. Kundrat,[2] in his monograph, "Arhinencephalie," describes brains which have no olfactory lobe, but are combined with other brain anomalies. Besides these two reports I was able to find one case reported by Valenti.[3] But according to Weidenreich all reports which he quoted lack detailed information, especially in that they do not discuss the area of the brain supposedly connected with the olfactory nerve and therefore called "rhinencephalon." Valenti's report contains no statement about this area.

In Weidenreich's case there was entire absence of the bulbus and tractus olfactorius in both hemispheres. We assume that the rhinencephalon governs the sense of smell as found by Broca and Zuckerkandl in their studies in comparative anatomy, and by Retzius embryologically. If this is true also in man, we should be able to see some change in the parts regarded as the olfactory center in brains that have no olfactory lobe. Weidenreich investigated carefully his case that dealt with the bilateral absence of the bulbus and tractus olfactorius, absence (right) and reduction (left) of the tuber olfactorius. Except for these defects, no parts of the brain regarded as the rhinencephalon showed any marked change which denotes atrophy; but he was not able to study his case histologically because of the unsuitable previous treatment of the material for this purpose. He concludes the question of the olfactory center with the sentence: "Auch die Lösung diesser Frage bleibt also aufgespart, bis der Zufall eine neue Beobachtung des Defectes bringt und zugleich die Möglichkeit einer sofortigen Untersuchung am frischen und entsprechenden fixirten Material."

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1. Weidenreich: Ueber partiellen Riechlappendefekt und Eunuchoidismus beim Menschen, Ztschr. f. Morphol. u. Anthrop. **18**:157, 1914.

2. Kundrat; Arhinencephalie, 1882, abstr. in Schwalbe; Die Missbildungen des Kopfes, 1913.

3. Valenti: Un cas d'absence unilatérale de l'appareil olfactif, Arch. ital. de biol. **64**:457, 1911.

It is many years since Broca and Zuckerkandl announced that the gyrus fornicatus must be regarded as the cortical olfactory area (it must be understood that under the name gyrus fornicatus or rhinencephalon are included gyrus cinguli and gyrus hippocampi with cornu ammonis). Although I am inclined to believe that certain portions of the rhinencephalon govern the smell sense, the part that subserves this function is still unknown, especially in man.

The authors quoted are arranged according to the year of publication.

Examination of animals has convinced Ferrier (cited in Bechterew's paper) that the olfactory center is located at the lower extremity of the temporal lobe. Munk (also cited by Bechterew) seeks it in the neighborhood of the cornu ammonis.

Onodi [4] concludes, after investigation of the hitherto published clinicopathologic reports concerning the sense of smell, that the olfactory center might be traced into the gyrus hippocampi and the uncus.

Ramón y Cajal,[5] from a histological study of the brains of several animals as well as that of man, has reached the conclusion that the focus spheno-occipitalis, the subiculum, the focus pra-esubicularis and the cornu ammonis seem to have no direct connection with the olfactory nerve fibers, and that they probably represent the tertiary olfactory center.

Campbell,[6] chiefly from histologic study of the human brain, recognizes the cross relation between the lobus pyriformis (frontal pear-shaped part of the gyrus hippocampi) and the cornu ammonis, but he doubts whether Ramón y Cajal is right in regarding the latter as a tertiary olfactory center. One of his conclusions is "Histology supports comparative anatomy in suggesting that in the human brain the lobus pyriformis must be regarded as the principal cortical center, although not the sole one governing the olfactory sense."

Broadmann [7] distinguishes the gyrus hippocampi from the surrounding areas on the ground of the histologic construction and names it "area ento-rhininalis."

Bechterew [8] concludes, from the results of experimental investigation on sixteen dogs, that an olfactory center is located apparently in

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4. Onodi: Die Rindencentren des Geruches und der Stimmbildung, Arch. f. Laryngol. u. Rhinol. 14:74 1903.

5. Ramón y Cajal: Studien über die Hirnrinde des Menschen, No. 4, 1903.

6. Campbell: Histological Studies on the Localization of Cerebral Function, New York, G. P. Putnam's Sons, 1905.

7. Brodman: Vergleichende Lokalisationslehre der Grosshirnrinde in ihren Prinzipien dargestellt auf Grund des zellenbanes, Leipzig, 1909. Brodmann: Feinere Anatomie des Grosshirns in Lawandowsky: Handbuch der Neurologie, Vol 1.

8. Bechterew: Die Funktionen der Nervencentra, 1911.

the lobus pyriformis, and that this must be regarded as the perception center for the sense of smell, while perhaps the neighboring region (subiculum cornu ammonis, Bechterew) may have the function of its conception.

Edinger [9] seems to approve the cornu ammonis for this center chiefly from the comparative anatomic standpoint.

As I have mentioned above, our knowledge of the olfactory center is limited. Campbell declared after covering the histologic evidence:

> Above all things we seem to lack the knowledge which in the case of some other cortical regions has proved so valuable. I refer to that derived from studies in pathological history; for instance, we have much to learn of the cortical changes attending uncomplicated atrophy or lesion of the olfactory bulb and peduncle, and have virtually no conception as to what subdivisions such changes would be distributed over.

Fortunately, through the generosity of Dr. Southard, I was permitted to investigate a brain that had no olfactory tracts. I will give the macroscopic and microscopic findings of this rare and interesting case, describing particularly those parts of the brain which have been suggested as having intimate connection with the olfactory sense. I shall endeavor to throw some light on the question of the olfactory center which seems to be so obscure.

REPORT OF A CASE

History.—F. S. H. 228, S. B. I. 1916. 87 (from the record of the Foxborough [Mass.] State Hospital), R. R., a man, aged 45, had epileptic dementia, the probable cause of which was heredity. The psychosis had been of gradual onset and of over fourteen years' duration, and had been characterized by periodic attacks of an epileptiform nature during which the patient lost consciousness, had generalized clonic convulsive movements, bit his lips and tongue and had loss of sphincter control. Following these attacks the patient was weak, befogged and depressed. He also had periods of depression and at times of excitement, auditory and visual hallucinations, with delusions of persecution. His judgment and emotional fields were markedly impaired, and there was general mental deterioration with no insight. He was admitted to the hospital April 17, 1907, and died July 13, 1916. Necropsy was performed by Dr. M. M. Canavan, eleven hours after death.

Anatomic Diagnosis.—This included brown atrophy of the heart muscle; ascites; calcified lymph node in mesentery; bladder distended; chronic perisplenitis; sclerosis of the mammary arteries; hydrothorax; hydropericardium; sclerosis coronaris; tricuspid and mitral stenosis; chronic fibrous endocarditis, mitral; chronic fibrous endocarditis, aortic; acute vegetative endocarditis, aortic; possible bronchopneumonia; pulmonary infarcts; accessory spleen; uric acid deposits, kidney (?); pigmentation, fibrotic spots; focal opacities, pia; absence of lobus olfactorius; soft cerebellum.

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9. Edigen: Vorlesungen über den Bau der nervosen Zentralorgane, 1911.

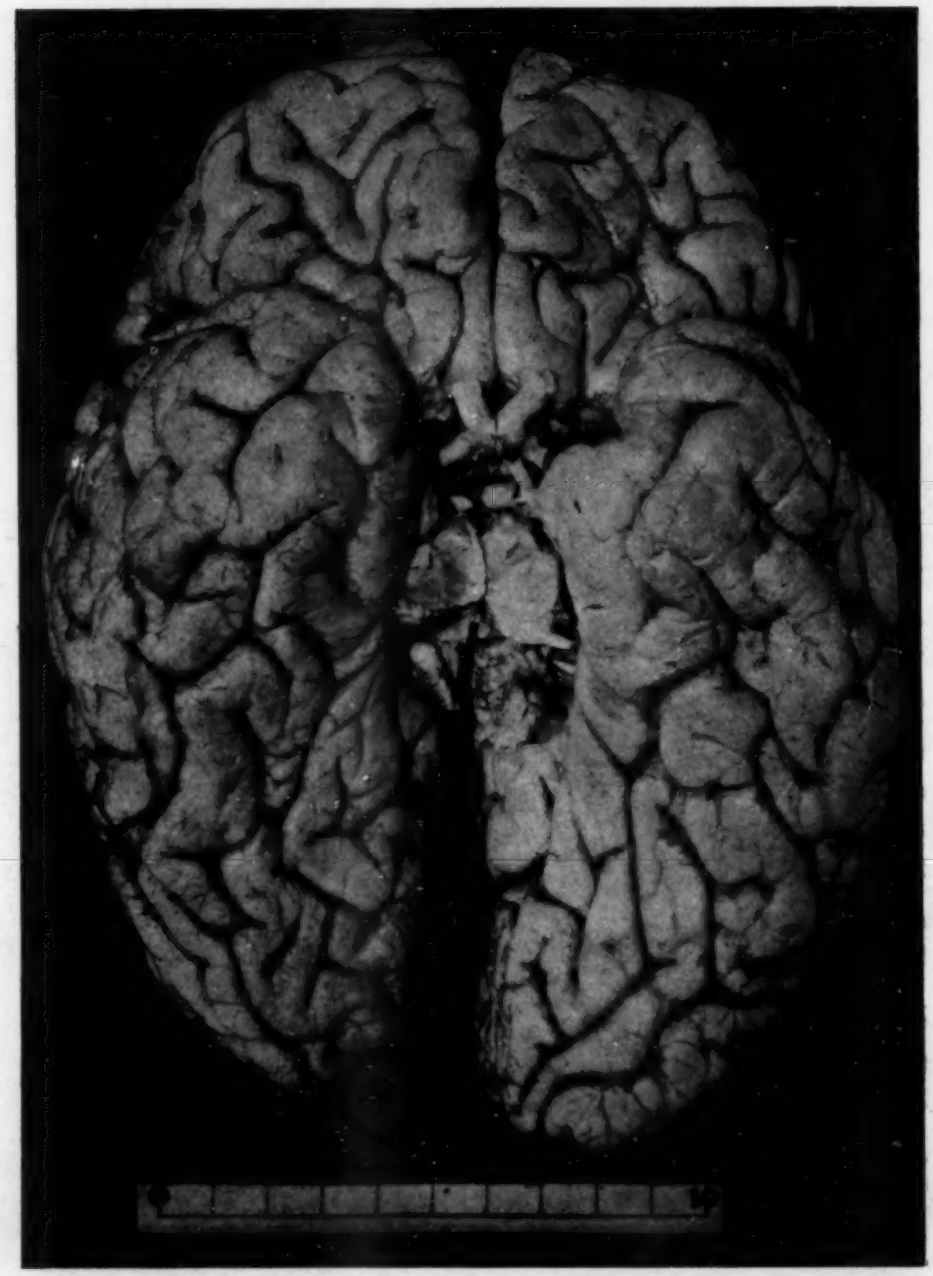

Fig. 1.—The base of the brain entirely bereft of bulbus and tractus olfactorius; rudimentary development of trigonum olfactorium and sulcus olfactorius are noticeable.

MACROSCOPIC STUDY OF THE BRAIN

In general form and size the brain was about normal. The pia mater showed focal opacities in the frontal and motor regions, and was nonadherent. The gyri in general were of normal richness and appearance and almost symmetrical. On the base of the brain the abscence of the bulbus and tractus olfactorius first attracted our attention (Fig. 7). There was slight sclerosis in the basal arteries. On careful stripping of the pia mater the findings in the rhinencephalon were: (The nomenclature in the following description has been adopted chiefly from Retzius.[10])

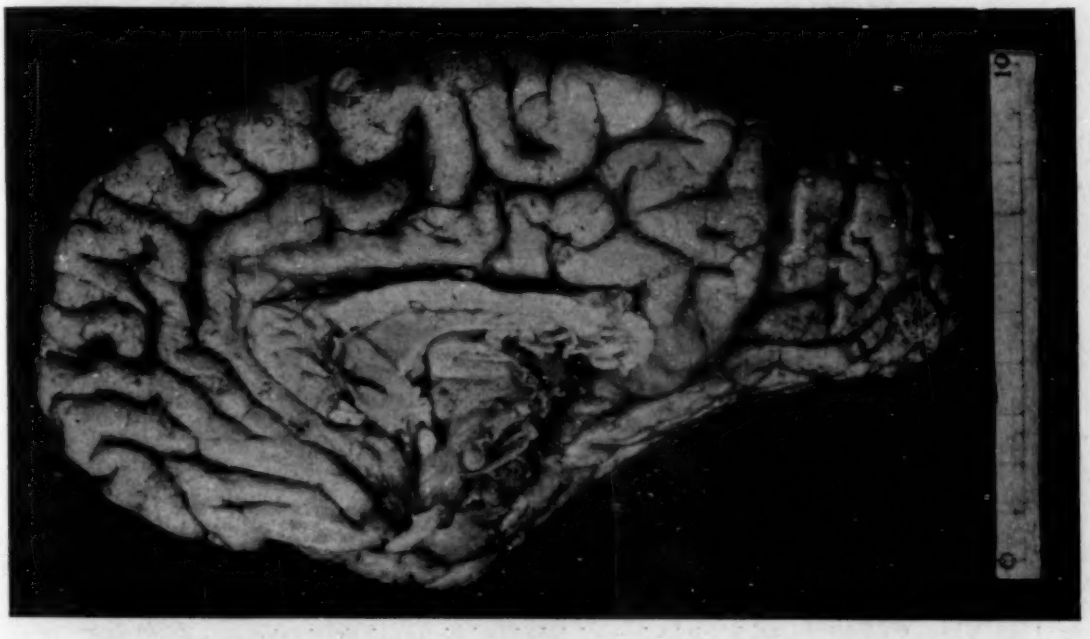

Fig. 2.—Mesial view of right hemisphere of the brain (see the description of macroscopic findings).

Right Hemisphere.—The weight of the right hemisphere after hardening in formaldehyd was 604 gm. The bulbus and tractus olfactorius were absent. Corresponding to the area of the trigonum olfactorium a flat and small pyramidal pointed process could be seen; both its sides and tip were free but the brain substance beneath adhered to its base. The tip of this process rested in a rudimentary sulcus olfactorius; no filia was to be seen. A rudimentary sulcus olfactorius ran forward from the top to the process described above

10. Retzius: Das Menschenhirn, 1896.

for about 1.7 cm., and divided into two short transverse branches. As far as this sulcus extended a gyrus rectus could be distinguished but at the end of the sulcus the gyri were bounded by a short transverse gyrus. Gyrus tuber olfactorius, gyrus olfactorius medialis and lateralis were not definite. Along the posterior ends of the gyrus rectus and gyri frontales a narrow convolution, a continuance of the area parolfactorici on the mesial surface, ran transversely into the limen insulae and separated the surface connection between the frontal lobe and the anterior perforated substance. The space of the latter was narrow. No stria of olfactoria was to be seen. Sulcus parolfactorius anterior connected upward with the sulcus cinguli, and by the sulcus

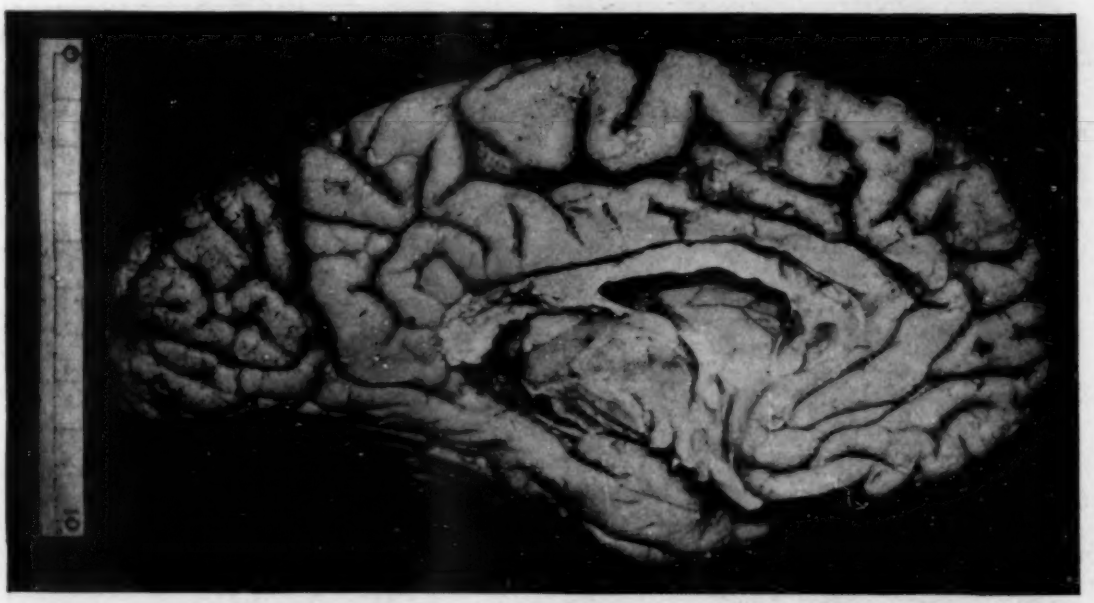

Fig. 3.—Mesial view of left hemisphere of the brain.

parolfactorius we could distinguish area parolfactoria and gyrus subcallosus, both pointing upward to gyrus cinguli (Fig. 2). The gyrus hippocampi was bounded anteriorly by incisura temporalis, above by the fissura rhinica in its anterior portion, and by sulcus collateralis on the posterior border; its length from the frontal tip to gyrus rhinencephalolingualis was about 4 cm. and seemed a little atrophied. From the inner sides of the hemisphere in which the crus cerebri was cut off could be seen clearly the whole length of the fascia dentate and the fimbria, and a part of the fornix through the dorsal surface of the gyrus hippocampi, with no pressing up of the thalamus. The gyrus semilunaris, sulcus semiannularis, gyrus ambiens and sulcus rhinica

inferior, which Retzius noted especially in the gyrus hippocampi, were easily identified. The uncus was well developed and bent sharply against the gyrus hippocampi as usual. The gyrus fusiformis was separated from the former gyrus by the fissura rhinica in its anterior portion and posteriorly by sulcus collateralis, with the exception of a narrow communication, gyrus rhinencephalofusiformis, located between the former fissura and the latter sulcus.

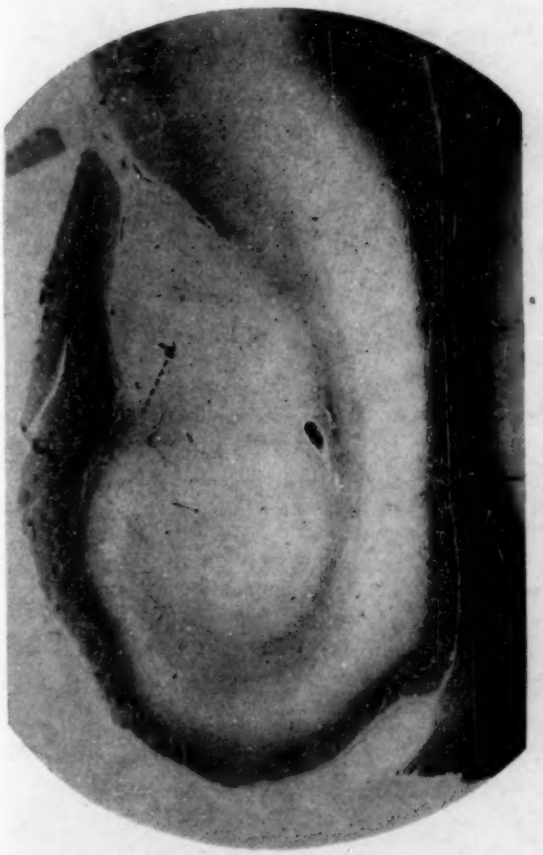

Figure 4

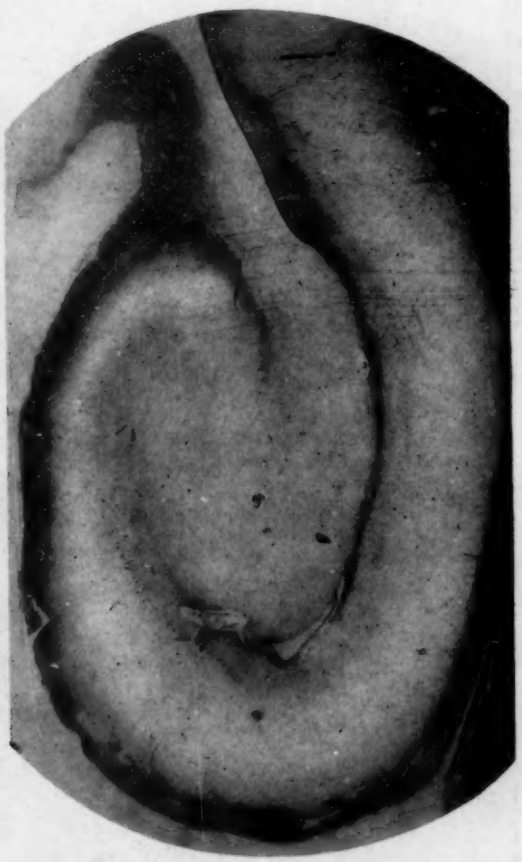

Figure 5

Fig. 4.—Section of the cornu ammonis (right), which is atrophied and the layer of gray matter remarkably narrowed. The deep branch of the alveus (*d*) which spreads into the terminal plate (into fascia dentate) is shortened and stains poorly (see also Figure 15). Compare this with Figure 5.

Fig. 5.—Section of about the same region of a normal cornu ammonis. Kulschitzky-Wolter's modification of Weigert's myelin sheath stain; thickness. 15 microns.

At its posterior extremity the gyrus hippocampi joined with the gyrus cinguli by gyrus rhinencephalolingualis, with gyrus cinguli and also with the precuneus by the isthmus cinguli as well as by precuneus anterior. The sulcus cinguli as the continuation of the sulcus parolfactorius anterior at its frontal end ran upward then backward around the genu corporis callosi and joined with the sulcus paracentralis, which separated lobulus paracentralis and precuneus. The gyrus cinguli was well developed and separated from the neighboring gyri by sulcus cinguli and subparietalis, from the corpus callosum by sulcus

Figure 6

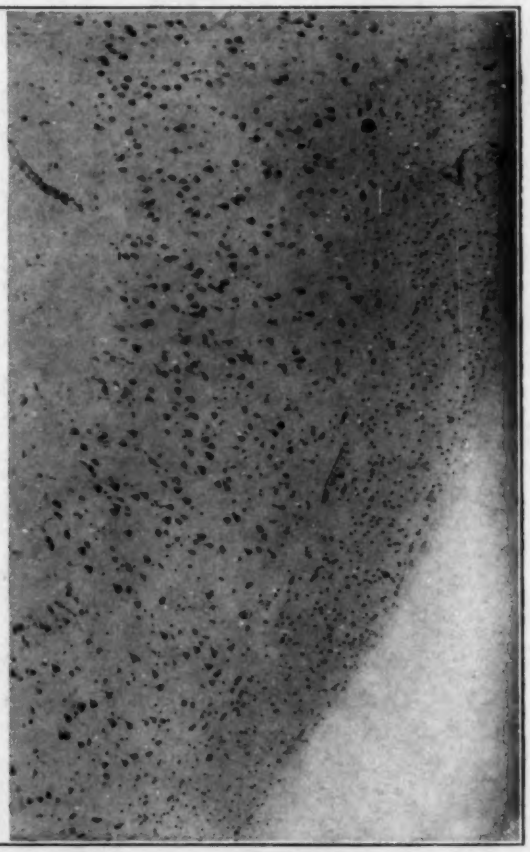

Figure 7

Fig. 6.—An area in the dorsal plate of a section of the cornu ammonis (left); cell layer is remarkably narrowed, pyramid cells are reduced in number and atrophied; thickened walls of blood vessels are also noticeable. Compare this with Fig. 7.

Fig. 7.—The same area as in Figure 6 of about the same region of a normal cornu ammonis. (Cresylviolet stain in paraffin section after formaldehyd and alcohol fixation; thickness 6 microns.)

corporis callosi. Its frontal end communicated with area parolfactoria and gyrus subcallosus; its posterior part was joined to the gyrus hippocampi. In the commisura anterior there was no notable change.

Left Hemisphere.—The weight of the left hemisphere after hardening in formaldehyd was 607 gm. The bulbus and tractus olfactorius were absent. In the place of the trigonum olfactorium there was a process of pyramidal form about the size of a kernel of corn, but it was not so flat as that of the right hemisphere; its tip was slightly free but the other parts adhered to the frontal lobe beneath. Gyrus tuberis olfactorii, gyrus olfactorius medialis and lateralis could not be differentiated; neither could the filia nor the stria olfactoria. The gyrus rectus could not be differentiated from the gyri frontales, and a sulcus olfactorius did not exist. The space of substantia perforata anterior was narrowed and separated from the orbital surface by a sulcus which ran from the mesial surface as the continuation of sulcus parolfactorius posterior. The gyrus hippocampi was 5 cm. long from its frontal tip to the gyrus rhinencephalolingualis and was bounded from the gyrus fusiformis by the sulcus collateralis. The fissura rhinica, gyrus semilunaris, sulcus semiannularis, gyrus ambiens and sulcus rhinica inferior could all be recognized. Generally the gyrus appeared to be a little atrophied, especially on the dorsal surface near the fissura hippocampi, where the convolution flattened and clear strands of the fascia dentata, fimbria and a part of fornix were to be seen from the inner sides of the hemisphere (Fig. 3). The sulcus cinguli, beginning as the continuation of sulcus parolfactorius anterior at its frontal end ran as usual almost parallel to the corpus callosum and combined posteriorly with the sulcus paracentralis. Gyrus cinguli, bounded superiorly by the sulcus cinguli and sulcus subparietalis, and below by the sulcus corporis callosi, was well developed and its posterior end reached to the isthmus rhinencephalolingualis as usual. The anterior end of the gyrus cinguli joined below to the area parolfactoria and gyrus subcallosus, which were as well developed as those of the right hemisphere.

HISTOLOGIC STUDY

Although there is no definite proof of the location of the olfactory center in the human brain, it is not difficult to assume that either the gyrus hippocampi or the cornu ammonis may govern the function. Therefore I made it my chief object in the microscopic study to examine these two regions. I took out the whole gyrus hippocampi with the cornu ammonis and the fascia dentata from both hemispheres. I investigated the fine construction and the lamination of nerve cells by the cresyl violet stain in paraffin sections, the arrangement of nerve fibers by Kulschitzky-Wolter's modification of Weigert's myelin-sheath stain in celloidin sections.

To obtain exact results I prepared as many serial sections as possible, and in order to avoid any misjudgment by comparison I investigated by the same methods the same regions of four other specimens which I had obtained from four normal looking hemispheres. I also examined other important areas of the brain.

Gyrus Hippocampi.—Cajal and Campbell have studied the normal histology of the gyrus hippocampi in detail. I state the findings in my case chiefly according to the topographical subdivisions by Ramón y Cajal, at the same time taking into consideration Campbell's description.

(*a*) The subiculum plexiform layer was about of normal thickness; deep in this layer islets composed of numerous minute triangular cells were seen as usual. Four or five of them were found in a section of the frontal area but much fewer in the posterior area. The pyramid and polymorphous cell layers were narrowed and many nerve cells, especially the pyramidal cells, were moderately shrunken with more or less affected nuclei. There was no change in the lamination and the cells were arranged in regular parallel rows as usual. Glia cells seemed to be increased.

(*b*) Praesubiculum: The tangential fibers in the plexiform layer ran irregularly; some were swollen and pear-like in appearance. The thickness of the gray matter beneath was reduced and many nerve cells, especially the pyramid cells, were moderately shrunken, but we were able to recognize the small pyramid and fusiform cell layer, the deep plexiform layer, the medium sized and large pyramid cell layer and the fusiform and triangular cell layer, as described by Cajal.

(*c*) The Hippocampal Gyrus Proper: The tangential fibers in the plexiform layer ran irregularly and were much fewer than normal. In the layer containing a cluster of polymorphous cells, the clusters of large polymorphous cells which characterize this area of the gyrus were to be found at the lobulus pyriformis, less toward the posterior end, but their protoplasm as well as their nuclei were markedly shrunken. The deep plexiform layer or medium sized pyramid cell layer, the large pyramid cell layer and the fusiform and triangular cell layer could all be differentiated, but many nerve cells, especially the pyramid cells, were considerably shrunken. As a whole, the cortex was narrowed. In Weigert's slides, there was no notable change in the arrangement of the radial fibers in the gray matter, but the interradial fibers among the former were few in comparison with those in brains having olfactory tract intact.

Cornu Ammonis and Fascia Dentata.—The histology of these organs in the human brain has been studied carefully by Kölliker,[11]

11. Kölliker: Handbuch der Gewebslehre, 6 te Aufl. 1896.

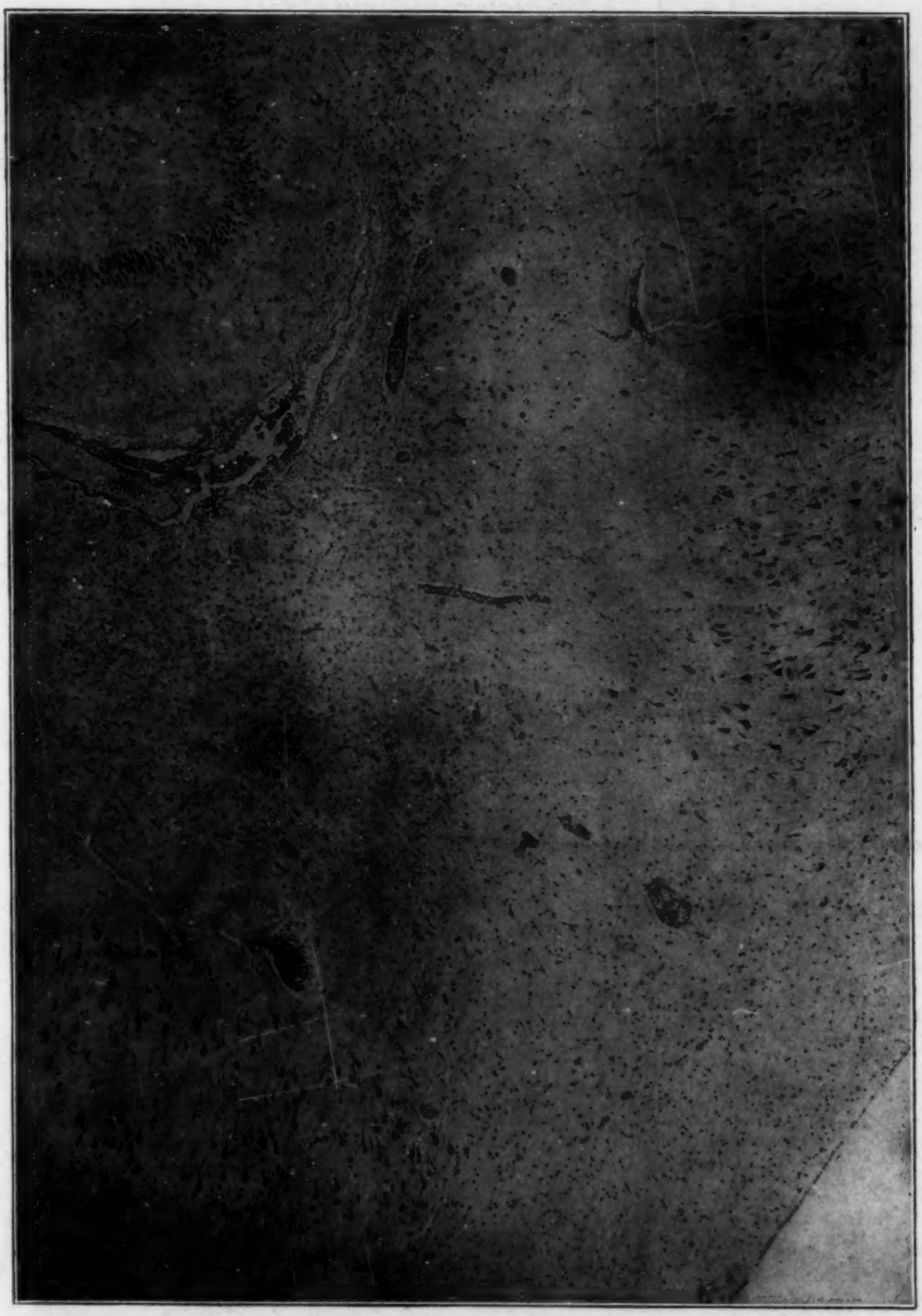

Fig. 8.—A gross gap of cell layer in the cornu ammonis (left). The pyramid cells have entirely disappeared in this lesion and it is filled up by neuroglia. Atrophy of pyramid cells is also noticeable. Formalin and alcohol fixation; cresyl violet stain; thickness 6 microns.

and Doinikow,[12] in his study of camparative anatomy, agrees with Kölliker.

(*a*) The Cornu Ammonis: The small size and the marked narrowing of the gray matter were noticeable at the first glance (Fig. 4).

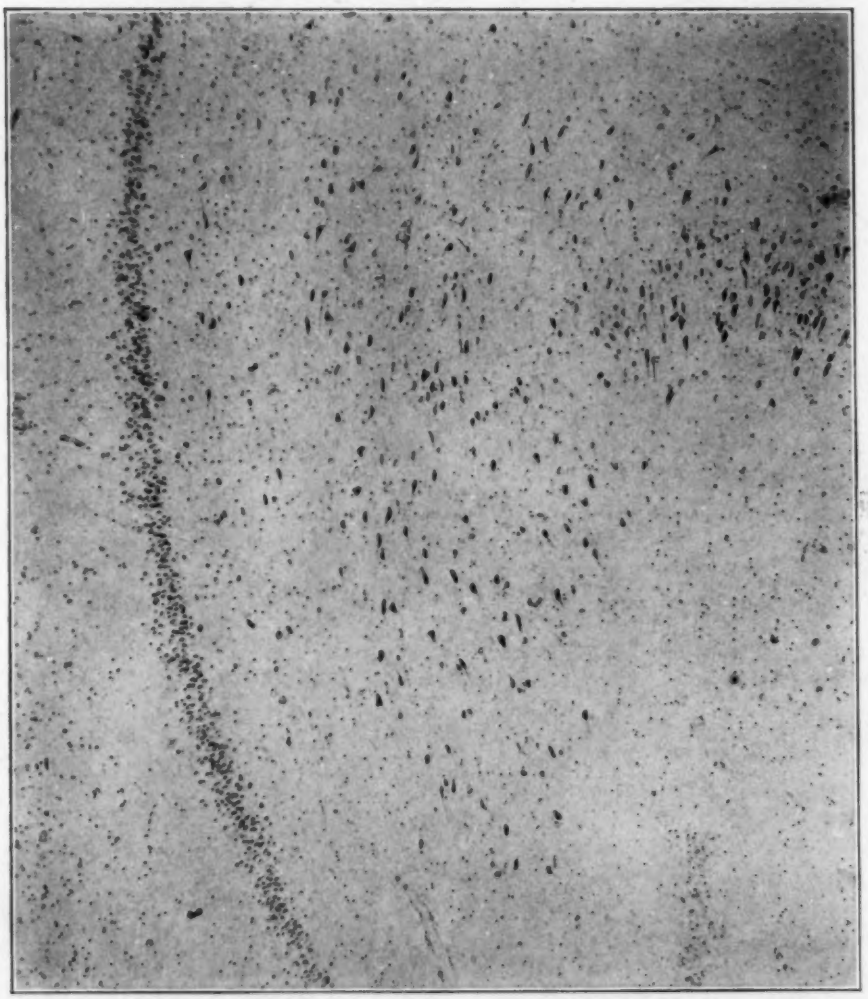

Fig. 9.—Alteration of nerve cells in the terminal plate of the cornu ammonis (left); they are reduced in number and markedly atrophied. Fine construction of these nerve cells can be seen in Figure 10. Compare with Figure 11.

The microscopic investigation of the sections disclosed: the stratum zonale was about normal in thickness; the superficial tangential, middle

12. Doinikow: Beitrag zur vergleichenden Histologie des Ammonshorns, Jour. f. Psychiat. u. Neurol. **13**:166, 1908.

longitudinal and deep tangential fibers could be differentiated. The glia cells were increased and the moderate thickening of the wall of the blood vessels was visible. The cell layer, stratum cellularum pyramidarium and stratum oriens were markedly narrowed as we recognized with the naked eye, and it was a striking fact that the pyramid cells which characterized this layer by their large size as well as by their number were not only much reduced and atrophied (Fig. 6), but in some positions they had entirely disappeared and these gaps of the cell layer were filled with neuroglia (Fig. 8). Many of the pyramid cells in this layer were also markedly shrunken; their Nissl's bodies could not be differentiated and their nuclei had disappeared. Such changes of the nerve cells could be seen through the whole cornu ammonis; generally they were more noticeable in its dorsal plate than in its ventral and they were most striking in the terminal plate, as seen in Figures 9 and 10. In the area near the gaps described the change of the pyramid cells was also remarkable and in these situations the several stages of the cell alterations could be seen; some of them maintained their cell bodies only as a thread-like shell, while others kept their pyramid form with more or less affected protoplasm and nuclei. The favorite locations of the gap seemed to be the transitional regions of each plate into the other, and as far as I examined I found two spaces in the frontal part of the left cornu ammonis and individual spaces in the frontal and in the middle part of the other.

In Weigert's stain not only could the narrowing of the layer of gray matter be seen clearly, but places in which the gray matter had almost disappeared and nerve fibers were pressed together as if they connected the stratum zonale with the alveus crosswise could be seen (Figs. 4 and 13).

The Alveus: This was about normal in thickness or thicker than normal along the dorsal plate; it divided into two branches as usual — the superficial branch went into the fimbria without notable alteration, but the nerve fibers of the deep branch which spread among the nerve cells in the terminal plate of the cornu amonis were few and fine in comparison with those of the normal sections (Figs. 15 and 16).

(*b*). The Fascia Dentata and the Fimbria: In the stratum zonale nothing important was found.

Stratum Granulosum and Stratum Polymorpheus: The form and fine construction of each cell, as well as the number in a row, were about normal except in one area in which the ventral portions approached the surface; in this lesion many of the cells were moderately shrunken with alteration in their nuclei.

The Fimbria: There was no noticeable change in the fimbria, except that there were many blood vessels with thickened walls among the bundles of nerve fibers.

Other areas of the brain investigated were: The gyrus cinguli, cyrus temporalis superior, gyrus frontalis superior, gyrus centralis anterior, gyrus centralis posterior and gyrus occipitalis superior.

Speaking generally, the changes which I recognized in these areas, so far as I examined them, were the moderate thickening of the plexiform layer, more or less shrinkage of nerve cells in the gray matter and light thickening of the wall of the blood vessels.

SUMMARY

There were bilateral absence of the bulbus and tractus olfactorius, rudimentary development of the trigonum olfactorium in both hemi-

Fig. 10.—Alteration of nerve cells in the terminal plate of the cornu ammonis (left); they are reduced in number and markedly atrophied. Fine construction of these nerve cells can be seen in Figure 10. Compare with Figure 12.

spheres, absence (left) and partial development (right) of the sulcus olfactorius, nondevelopment of the gyrus olfactorius medialis and lateralis as well as of the gyrus tuberi olfactori in both sides, absence of the stria olfactoria and some atrophy of the gyrus hippocampi in both hemispheres. The other areas, which are regarded as the rhinencephalon, showed no notable alteration.

Comparing this case with that of Weidenreich's, I find that there is no great difference between the two cases except in the incomplete development of the sulcus olfactorius and the atrophy of the gyrus hippocampi in my case.

As already mentioned, Weidenreich is of the opinion that, although the question of the olfactory center has not been solved by his case

report, because no macroscopic change was to be seen in the rhinencephalon, perhaps the olfactory nerves connected the center in some irregular way, as the patient seemed to have had some sense of smell during life.

In my case, the absence of the gyrus olfactorius medialis and lateralis as well as of the gyrus tuberis olfactorii and the stria olfac-

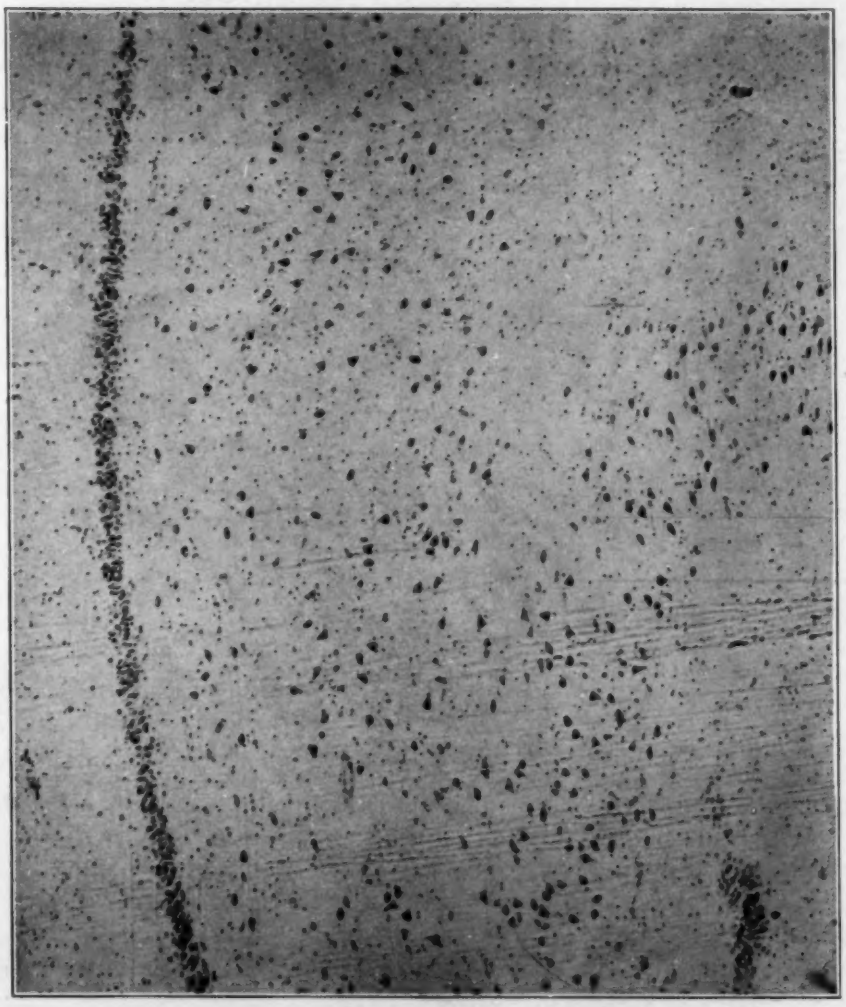

Fig. 11.—Nerve cells in the terminal plate of a normal cornu ammonis. Formaldehyd alcohol fixation; cresyl violet stain; thickness 6 microns.

toria—which were also lacking in Weidenreich's case—would not be of importance in regard to the question of the olfactory center, because the development of these gyri and stria depends directly on that of the bulbus and tractus olfactorius.

The flattened gyrus hippocampi, which I have described, attracted my attention in this case, and it would be interesting to know whether this atrophy in the rhinencephalon is to be regarded as the result of the absence of the lobus olfactorius. It is to be regretted that I could not get any positive information about the sense of smell of the patient during life. Such an important question could not be solved by the macroscopic investigation alone, and therefore I discuss it later in reference to the microscopic findings.

Concerning the origin of the defect of the olfactory lobe, according to the description by Ernst,[13] arachinencephaly, a brain without an olfactory lobe, may develop when some compression acts on the head

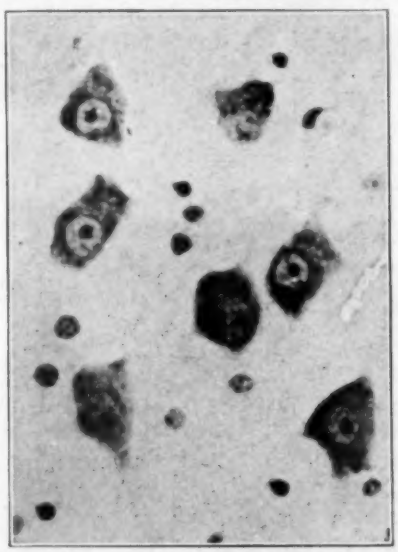

Fig. 12.—Finer details of these nerve cells shown in Figure 11. Formaldehyd alcohol fixation; cresyl violet stain; thickness 6 microns.

fold of the embryo. Schwalbe[14] states that the theory of compression as the cause of arhinencephaly and cyclopy has been shaken and the opinion that it is due to some embryonal defect is gaining more general acceptance.

Weidenreich is of the opinion that in his case the olfactory nerve could not combine with the olfactory lobe as usual, and consequently the latter was deserted to atrophy. The full development of the sulcus olfactorius in his case shows that the olfactory lobe might have

13. Ernst: Missbildungen des Nervensystem. Schwalbe: Morphologie der Missbildungen des Menschen und der Tiere, Teil III, Lief. 2, 1910.

14. Schwalbe und Josephy: Die Missbildungen des Kopfes. Schwalbe: Morphologie der Missbildungen und der Tiere, Tiel III, Lief. 11, 1913.

been developing for some time. He seeks the origin of the anomaly in some alteration of the embryonal connective tissue.

In the present case the sulcus olfactorius did not develop so fully but, in accord with Weidenreich's, the main anomaly has been limited to the lobus olfactorius with no remarkable change in the neighboring

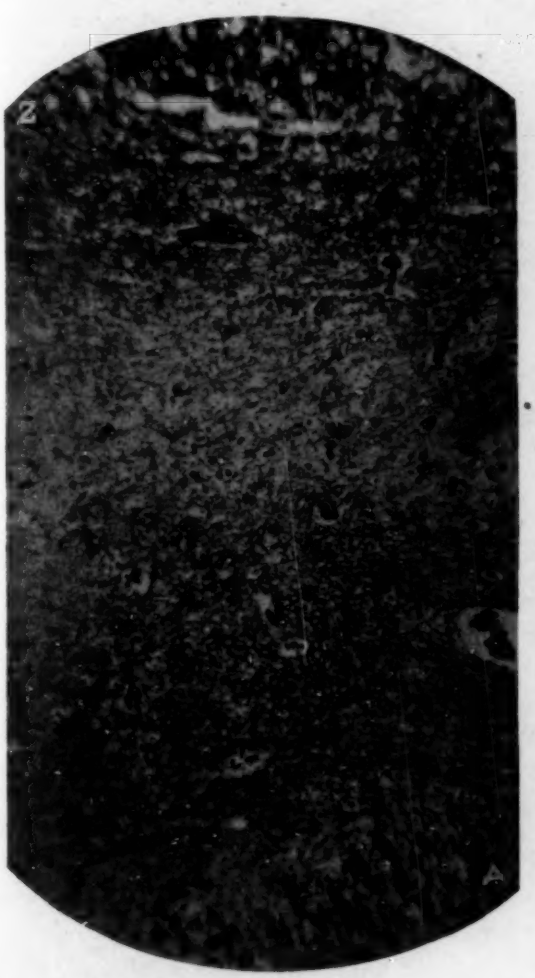

Figure 13

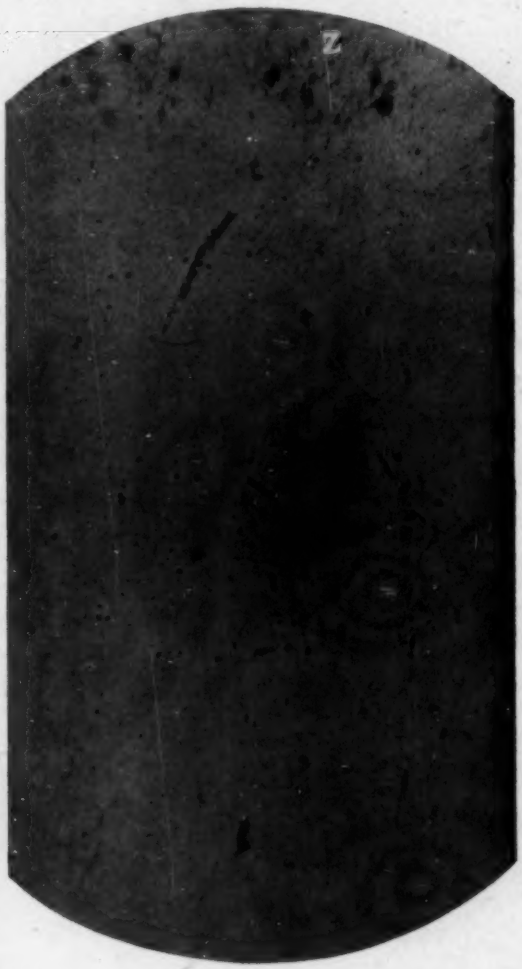

Figure 14

Fig. 13.—An area in the dorsal plate of the cornu ammonis (right); in this lesion the gray matter has almost disappeared and nerve fibers in the narrowed layer of gray matter are pressed together between stratum zonale (*Z*) and alveus (*A*). Compare this with Figure 14

Fig. 14.—The same area of about the same region of a normal cornu ammonis as in Figure 13 (Z—stratum zonale). Kulschitzky-Wolter's modification of Weigert's myelin sheath stain; thickness 15 microns.

areas of the forebrain. This is not to be explained by the compression theory, for if so, it must have been circumscribed as well as effective, and at the same time it must have acted on both hemispheres; but such a compression is not to be considered. I would not hesitate to believe that the defect of the lobus olfactorius might have had its origin in some defect in the embryonal tissue.

In the microscopic investigation the changes were found in the cornu ammonis. There were marked reduction in the gray matter, remarkable atrophy of pyramid cells and disappearance of the cell

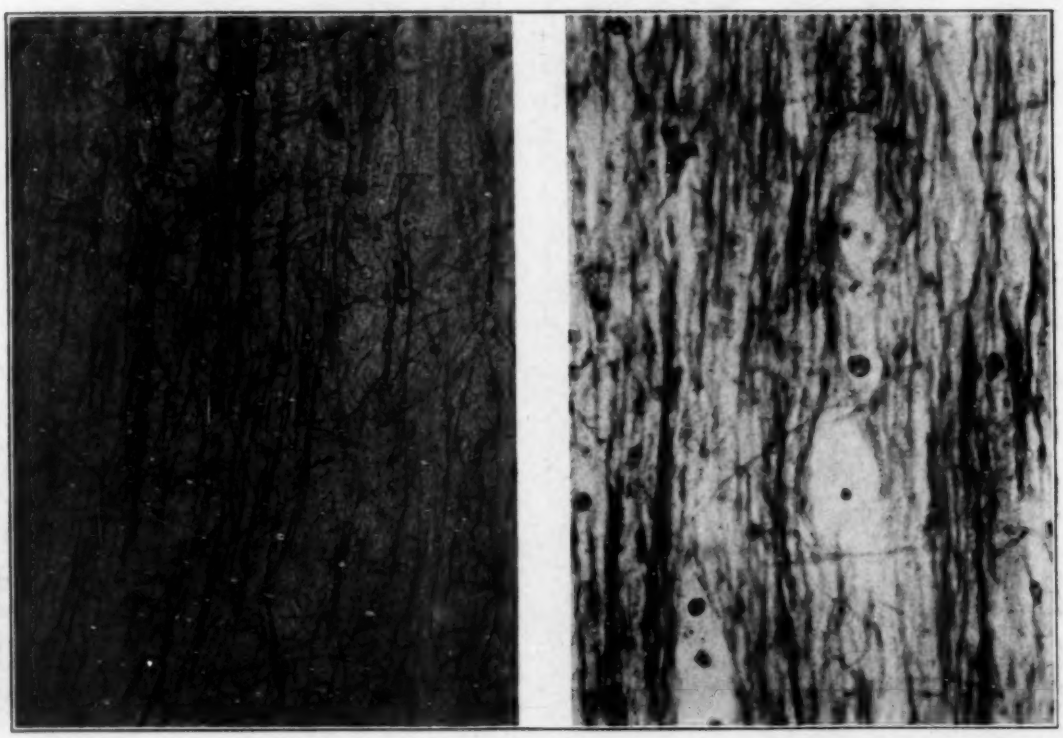

Figure 15 Figure 16

Fig. 15.—Fine construction of nerve fibers in the deep branch of the alveus (see also Fig. 4). The area presents itself just before the deep branch spreads among nerve cells in the terminal plate of the cornu ammonis (right). The nerve fibers are reduced in number and atrophied. Compare this with Figure 16.

Fig. 16.—Nerve fibers in the same area of about the same region of a normal cornu ammonis as in Figure 15. Kulschitzky-Wolter's modification of Weigert's myelin sheath stain; thickness 15 microns.

layer in some portions, fewer nerve fibers in the deep branch of the alveus, more or less increase of glia cells and thickenings in the walls of the blood vessels.

I believe that the change of the nerve cell denoted atrophy and not aplasia because the alteration was not the same through the whole cornu ammonis and, moreover, several stages of the change in the cells were seen.

Next to the cornu ammonis, the change in the gyrus hippocampi was most noticeable. The changes in this region were: less tangential fibers in the plexiform layer, marked atrophy of the superficial large polymorphic cells, moderate shrinkage of the pyramid cells and loss of the interradial nerve fibers.

It is interesting that to some extent these findings in the gyrus hippocampi accord with the result of the macroscopic investigation, which showed some atrophy of this gyrus. Moreover, it is extremely interesting to have found the most marked change in the cornu ammonis in my case, while the location of the olfactory center is still a question, and some authors, notably Ramon y Cajal, are suggesting the cornu ammonis as the terminal station of this sense.

According to His, quoted in Weidenreich's paper, the olfactory nerve develops separately from its central part and the connection with the brain is accomplished in a comparatively later stage. Therefore, it would not be unreasonable to expect some secondary change in the olfactory center, although it might have developed as usual. In this case in which there were no bulbus and tractus olfactorius, the cornu ammonis showed the most marked alteration in the so-called rhinencephalon.

Besides the anomaly of the olfactory lobe are there any other possible causes for this change to be considered?

Arteriosclerosis may be taken into consideration, as the thickening of the walls of the blood vessels was noted in the cornu ammonis; but the patient did not have marked arteriosclerosis and the basal arteries showed only a slight degree of the hardening. Hence an intense alteration in nervous tissue could not be explained by arteriosclerosis; moreover, the change in the nervous tissue was almost limited to the cornu ammonis.

Certain intoxications may be considered, but in the clinical history there is no evidence of any kind of intoxication as a probable cause of such a change in the nervous tissue. General intoxication would not cause the most marked change in the cornu ammonis; hence this cause may also be excluded. May I then conclude that I have eliminated doubt regarding the olfactory center, and that the cornu ammonis must be regarded as the terminal olfactory center?

Unfortunately, the patient suffered from epilepsy of long duration, as briefly described in the history. Since the sclerosis of the cornu

ammonis in epilepsy was called to attention by Meynert, Sommer,[15] Bratz,[16] Arzheimer,[17] Worcester [18] and Southard [19] by histologic studies on this subject, I shall not give the results of the investigations of each one of these authors. It seems to be true that in several cases of epilepsy discussed by these physicians, some alterations — especially atrophy of pyramid cells, increase of glia cells and sclerosis of blood vessels were found in the cornu ammonis. This complicates the value of similar findings in the present case, as the defect of the lobus olfactorius cannot be excluded as a possible cause of these changes in the cornu ammonis. A discussion as to which of the two possible causes is more reasonable or was more effective in this case should be avoided, as any conclusion in this discussion appears to be only an assumption.

Although it is regrettable that this case could not bring out the soundest evidence necessary to solve the question of the olfactory center, I believe such a case and such an alteration in the cornu ammonis is a matter of enough interest to be reported and may be a contribution to further investigation on this question.

In closing this report I wish to acknowledge my great indebtedness to Dr. E. E. Southard and Dr. M. M. Canavan, whose kind help enabled me to investigate the brain discussed. I also wish to thank Mr. Herbert W. Taylor, a photographer, who prepared the photographs.

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THE ASSOCIATION OF NEUROPSYCHIATRIC CONDITIONS WITH INFLUENZA IN THE EPIDEMIC OF 1918

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In the section of neurology and psychiatry of the office of the Surgeon-General of the Army are filed statistical and clinical records of over 70,000 neuropsychiatric cases reported from the various camps and hospitals in the United States during the war. Of these records, 269 have reference to influenza, the disease having been present at some time during patient's army service. A careful consideration of the records, however, made it apparent that in only seventy-three cases could influenza be deemed a significant factor in the development of the neuropsychiatric condition reported. These have been made the basis of the following study.

NEUROPSYCHIATRIC CONDITIONS ASSOCIATED WITH INFLUENZA

Infective-exhaustive psychosis	32
Dementia praecox	7
Manic-depressive psychoses	4
Psychoneuroses	19
Constitutional psychopathic state	2
Mental deficiency	2
Paralysis of the facial nerve	2
Neuritis	2
Cerebral embolism	2
Hyperthyroidism	1
Total	73

It is certain that the cases set apart for this discussion do not include all cases in the army that presented neuropsychiatric manifestations. Toward the latter part of the epidemic a number of cases undoubtedly were not brought to the attention of the section of neurology and psychiatry, owing to a change in the method of disposition of reports. It is also probable that many influenza patients had nervous and mental complications while under the care of the general medical officers, these cases not having been brought to the notice of, or placed in charge of, neuropsychiatrists. In connection with the question of the actual number of such cases, the experience of Major Egbert Fell at the Walter Reed Hospital is apropos. Dr. Fell states that of approximately 2,500 cases of influenza treated at the hospital, only twenty developed psychoses, and only four of these were of a severe type outlasting the acute disease.

The series of cases under consideration were widely distributed in the United States, being reported from eight camps, ten general hospitals and two embarkation hospitals. The largest group, comprising thirty-two cases, includes those which may be designated as the infective-exhaustive-toxic type. There were nineteen cases of psychoneuroses, four cases of manic depressive psychosis, seven of dementia praecox, four of neuritis and seven miscellaneous. The majority of these soldiers were within the first draft age. Twenty-two saw foreign service; the remainder did not leave the United States.

The group of thirty-two cases of the infective-exhaustive-toxic type comprises those which commonly presented marked physical reactions, and which appeared most properly to be connected with an acute illness such as influenza. These cases were variously diagnosed, such terms as infective, toxic, somatic, exhaustive, infective-exhaustive and toxic-exhaustive being used. It was rather usual to find evidence of physical exhaustion, e. g., tremor, anemia, loss of weight and so on. The symptoms varied from a mild confusion of bewilderment to a marked delirium with agitation, hallucinations, amnesia, ideas of persecution of hypochondriacal nature and other evidences of a severe psychotic reaction. In ten cases there is definite mention of hallucinations. Both restless excitement and depression are recorded as being about equal in frequency. Ideas of self accusation with a strong sexual coloring were present. In one case, there was a marked tendency to fabricate. The usual disorientation accompanied frank delirium. Of the thirty-two cases, ten patients were reported as returned to duty, ten more as recovered, seven recommended for discharge from the service and three were transferred to general hospitals for further treatment. In two cases there was no record as to disposition.

In only one of the thirty-two cases, had there been a previous attack or any history of predisposition. This soldier, a second lieutenant, had had a nervous breakdown seven years before, necessitating residence in a sanatorium and characterized by depression during which he cried easily. During his second psychosis he was excited, talked to every one about his trouble and had the idea that his stomach and testicles were eaten away. He thought he was being poisoned and vomited constantly. He was discharged from the service. The diagnosis of "infective psychosis" might be questioned, and the diagnosis of manic depressive insanity might be considered.

Seven patients had tainted family histories consisting of insanity, epilepsy, meningitis, neurotic disposition; none of these appeared to be of special significance.

Of this group the following case is abstracted to illustrate simple confusion and bewilderment with final recovery.

REPORT OF CASES

CASE 1.—*History.*—Private B., aged 31, single, white, an automobile mechanic, had one sister who was nervous and two paternal uncles who were alcoholic. Otherwise the family history was negative so far as ascertained. As a child he had measles, mumps and scarlet fever. He attended school from the age of 6 to 15, reaching the eighth grade. He was active in sports. As an automobile mechanic he worked steadily, earning $5 per day. He denied venereal disease, and was a moderate user of beer.

He was drafted May 1, 1918, and was sent to Camp Humphrey, May 23, 1918.

Present Illness.—About October 10, he was taken with influenza. He was in barracks until October 17, when he was admitted to the Base Hospital. On October 24 he was found wandering about the Officers' Ward at the Base Hospital. He seemed to be bewildered and was transferred to the neuropsychiatric ward for observation.

On admission he was in a poor state of nutrition. He was disoriented for time, but not for place or person and was fairly coherent and relevant but complained of being "mixed up in the head." No hallucinations were noted. He constantly ran to the office saying he had a ticket and wanted to catch the next train home. He appeared to be "demented," and it was almost impossible to keep him in bed. He had difficulty in understanding what was said to him.

He gradually improved and finally recovered. At first his memory for recent dates was impaired, but this returned and he was perfectly clear on Nov. 7, 1918. He was returned to duty.

The next case presents symptoms of confusion, restlessness, hallucinations and ideas of persecution with final recovery. There were decided signs of physical exhaustion. He had also an attack of measles.

CASE 2.—*History.*—Private G., aged 24, single, white, a farmer, had a negative family history so far as could be ascertained. Little information was received about his early life. He had had jaundice and chickenpox. He was a moderate user of beer. He had attended college for one year.

Present Illness.—On Sept. 15, 1918, after being in the service about three months, he developed influenza. Prior to this he had symptoms of measles; he was restless, rather silly and confused. For a time he heard voices telling him he was to die and saw Germans digging a trench in which to bury him. He thought he was accused of being pro-German and a spy.

Physically, he was poorly nourished, anemic and under weight. The pupils were unequal, but reacted normally. The blood Wassermann test was negative.

He gradually improved and recovered by Jan. 17, 1919. He returned to duty.

The following case was characterized by delirium, hallucinations and amnesia.

CASE 3.—*History.*—Private H., aged 29, married, of mixed race, a farmer, had a negative family history as far as it could be ascertained. The history of his early life was negative. He reached the sixth grade in school. He was married and in comfortable circumstances. He was drafted June 17, 1918, and sent overseas four months afterward, remaining three months and then returned to the United States.

Present Illness.—He contracted influenza on board ship on the trip over, being admitted to a base hospital on Sept. 24, 1918. He was then confused, disoriented, restless and had auditory hallucinations. He improved but remained dull, perplexed and worried for some time. Later he recalled the trip over and back but remembered little, if anything, of his psychosis. By March 5, 1918, he was considered well and he was sent home with an attendant.

One soldier showed a tendency to fabricate which persisted for a week.

Case 4.—*History.*—The family history of Private H., aged 21, single, white, farmer, could not be ascertained. Very little was known of his personal history. He was said to have reached the second grade in school and could read and write. He had always worked on a farm. He never used alcohol or drugs. He served in the army four months, remaining in the United States.

Present Illness.—He had influenza with bilateral bronchopneumonia. The psychosis continued three weeks. Influenza began Sept. 28, 1918. By Oct. 17, 1918, he had recovered from his bronchopneumonia but at that time phlebitis of the left saphenous vein was noted. On Oct. 30, 1918, his first mental symptoms were observed. He was disoriented but cooperated well. He told of having enlisted in the regular army a year before, but was unable to give the data. He stated also that he had been in France, had participated in a bayonet charge and fought for half a day, but he could not give the name of the battle. He said that he had landed in New York about two months before. This was all pure fabrication and he continued this prevarication for a week, after which his mental condition cleared up and he became apparently normal. He was finally discharged from the service.

There were several cases of dementia praecox, six reported of the hebephrenic type, one a simple form. All were white, and their ages ranged from 21 to 31 years. Three saw foreign service, the others remained in the United States, the length of service ranging from three months to over two years. Six were eventually recommended for discharge from the service, two being transferred to St. Elizabeth's Hospital, and one continued under treatment in another army hospital. All were recorded as in line of duty with one exception.

Several of these soldiers served from six months to over one year in the United States prior to going to France where influenza was contracted. From the length of service in this country and the fact that they were selected for overseas duty, probably undergoing two neuropsychiatric examinations, one at the beginning of their service and the other for overseas duty, it may be supposed that they showed few if any mental abnormalities, and that the psychosis as it later appeared in association with influenza was a new development. Other writers have commented on the onset of dementia praecox as an acute psychosis with or following influenza, and these cases would appear to confirm such a possibility. On the other hand, at least one of these soldiers gives the history of having "always been seclusive" and showing a lack of initiative. From this, it would also appear that there may

be in the patient a background of peculiar makeup, on which as a basis the acute illness brings to light the psychotic condition.

In five of these cases auditory hallucinations were present. In several patients, ideas of persecution were reported, such as that food was poisoned; but these symptoms were evidently not so prominent as to cause the examining officers to favor a diagnosis of paranoid praecox. One case began with great excitement and psychomotor unrest followed by rather rapid deterioration, especially in the emotional field.

The following case illustrates the onset of dementia praecox, hebephrenic form, after some months of apparently efficient army service, following an attack of influenza while in France.

CASE 5.—*History.*—Private F., aged 30, single, white, farmer, had a negative family history, so far as could be ascertained. Little information could be obtained about his early life. He had measles in 1910. He denied syphilis and alcoholism.

Present Illness.—After six months' service in the United States, he contracted influenza in France in October, 1918. He became seclusive and had auditory hallucinations, hearing voices of girls using indecent language and asking him to marry them. He asserted that people read his mind. He talked little. He was oriented for time and place. With the exception of an acne eruption on the face, his general physical condition appeared to be good.

He continued under observation for about six months, finally being discharged.

The following case illustrates the onset of dementia praecox after a longer period of army service both in the United States and in France.

CASE 6.—*History.*—The family history of Private P., aged 25, single, of mixed race, a farmer, was negative, so far as could be ascertained. Little information as to early life could be obtained. He reached the eighth grade in school. He was drafted July 22, 1917, served one year and four months in the United States, and one year in France. He was a moderate drinker.

Present Illness.—He contracted influenza while in France in October, 1918, having severe chills and fever, a cough and pain in the left side of the chest. He talked incoherently and excitedly. There were marked psychomotor activity and visual hallucinations.

This mental state continued although his physical condition became normal. In December, 1918, he became quiet and apathetic and irrelevant in conversation, showing evidence of hallucinations and delusions. He said that God talked with him; that his food was poisoned; that his bones seemed to draw electricity from the lights in the building. He talked continuously to himself. Orientation and memory were defective. After four months of observation, he continued to be disturbed and resistive, apathetic, untidy and expressed the same ideas. He was transferred to St. Elizabeth's Hospital, Washington, D. C.

With no history of previous peculiarity aside from shut-in personality, the following officer developed dementia praecox after influenza and bronchopneumonia.

CASE 7.—*History.*—Lieutenant G., aged 30, single, of mixed race, a dentist, had a negative family history so far as could be asscertained. He was of the

"shut-in" type of personality. Little information about further details of personal history could be obtained. He denied syphilis, alcoholism and drug addiction.

Present Illness.—He had influenza followed by bronchopneumonia in December, 1918. He complained of feeling "nervous" and "fearful"; he evaded questions and resisted examination, and thought the latter was for the purpose of circumcising him.

He had periods of excitement when he became noisy and destructive. He was unstable emotionally, frequently crying without reason, and talked of being related to Jesus Christ. He said he was to marry a girl who would bear him a child who would be a second Jesus Christ. He worried over a real financial indebtedness, but memory was clouded for recent events in general.

At first he seemed to have increasing insight and to be improving. Later he became more tractable, laughing easily, showing marked religious tendencies and reading the Bible much of the time. He spoke of "raising thoroughbred horses" as his "natural vocation," and dentistry as his "artificial vocation." He had some idea that his food was poisoned.

He was under treatment in four army hospitals, going away without official leave while in the second and going to Washington to interest the President in moving the World's Peace Congress to the United States; he was apprehended in Washington. He seemed to be deteriorating as evidenced by carelessness in appearance. He thought his case was parallel to that of Joan of Arc.

Of the four cases of manic-depressive insanity, three were cases of depression. Three patients had seen considerable service, one nine months in the United States and five months in France, another six months in the United States and twelve months in France, the third seven months in the United States and eight months in France. One of these cases had been diagnosed in France as "hysteria." Another patient who had profound depression with suicidal threats, had had a previous attack three years before which lasted for six months. A third, a negro, attempted suicide by cutting his throat with a razor during convalescence. He recovered. The fourth patient showed excitement after three months of service in the United States, characterized by a mild exhileration with restlessness and talkativeness, with final recovery; he returned to duty after two and one-half months.

The patient in the following case showed symptoms of a mild manic attack, with eventual recovery. A history of syphilis and a few suggestive physical signs complicate the picture. There is no record of a Wassermann test of the blood or a spinal fluid examination.

Case 8.—*History.* Private P., aged 26, married, English, a chauffeur, had a negative family history for nervous and mental diseases so far as could be ascertained. His father had tuberculosis. Little information as to personal history could be obtained. He reached the eighth grade in school. He had pertussis at the age of 8, measles at 10 and mumps at 15. He was a moderate drinker. He contracted syphilis about three years before.

Present Illness.—After three months' service in the army, he had an attack of influenza on Oct. 19, 1918, remaining in the hospital eight days. On November 8 he sprained his wrist and was in the hospital for about two months.

He was restless, mildly exhilerated and talkative. He spoke constantly of army experience and showed much egotism. Orientation and memory were undisturbed. Judgment was poor.

Physical Examination.—All deep reflexes were exaggerated. The right pupil was slightly irregular in outline. Reacton to light and accommodation was fairly good. He complained of failing vision.

Course.—He made good progress and was recommended for return to duty, but was transferred for demobilization Jan. 31, 1919.

The next patient not only had a previous attack of mental trouble before army service, but also had a psychoneurotic manifestation from which he recovered, prior to the psychosis following the attack of influenza. The latter was characterized by marked depression with eventual recovery.

Case 9.—*History.*—Private F., aged 22, single, American, a college student; his mother was said to be insane. Little information was available. As a child he had measles and whooping cough, and chickenpox when 18. When drafted he was in his second year in college.

Three years before enlistment, he had a "nervous breakdown" that lasted six months during which he was depressed, had difficulty in thinking and contemplated suicide. He enlisted in June, 1917, and went overseas in August of the same year. In October, 1917, he "broke down," having a jerking and twisting of the head. He returned to his company in December and was well until July, 1918.

Present Illness.—In July, 1918, he had influenza. Following the acute febrile condition, he became stupid, dazed, had difficulty in concentration, was depressed, refused to talk or eat and threatened suicide. He heard the voice of God commanding him to save the world, to become a Catholic and to take religious vows. He thought his father was responsible for his mother's insanity. He gradually improved and was returned to the United States about Oct. 1, 1918.

There were no physical symptoms.

By the middle of December, 1918, he showed no abnormalities except a slight retardation of thought and speech. Intellectually he appeared normal. The recommendation was then made that he be held until recovery was complete and discharged on certificate of disability as not in line of duty.

The nineteen cases of psychoneurosis consisted of thirteen of neurasthenia, five of hysteria and one of psychasthenia. All but one of the patients with neurasthenia were enlisted white men between the ages of 20 and 31, only four of whom had seen overseas service. The symptoms developed as a rule during the convalescent period following influenza, and every case was characterized by considerable fatigue, or feeling of "weakness." Besides the fatigue, there were found tremors, numbness, hyperesthesias, dyspnea and mild depression. Four cases were recommended for discharge, eight held at general hospitals for longer observation and one returned to duty.

In the following case symptoms of fatigue with mild depression, insomnia and tremulousness when excited developed during convalescence from influenza.

CASE 10.—*History.*—Corporal O., aged 20, single, of mixed race, a student, had a neurotic mother. Little information concerning the personal history was available. He had reached the second year in college when he entered the army, enlisting Jan. 12, 1918. He had had measles, mumps, pertussis, and four attacks of pneumonia.

Present Illness.—This dates from Jan. 8, 1919, during convalescence from influenza, the latter lasting from December 15 to December 30. His chief symptom (subjective) was a complex characterized by physical and mental fatigue and attended by a host of other symptoms, mostly subjective and for which there seemed little basis. He was somewhat depressed and introspective. He appeared to be nervous and was easily excited, in the latter state being tremulous and weak. He easily tired from mental or physical effort. He was irregular in sleep, dreaming much. He was under observation for several months and was transferred to a general hospital for further observation.

The physical examination was negative. There were no organic symptoms.

This soldier contracted influenza and pneumonia in France with subsequent fatigue symptoms. After several months of treatment, he was restored to duty.

CASE 11.—*History.*—Private S., aged 25, single, of mixed race, a farmer; his sister had "nervous breakdown." As a child he had measles, mumps, and whooping cough. He was of a rather low grade mentally, never advancing above fourth grade in school. He denied syphilis, alcohol and drugs. The total length of his service was one year and ten months, one year of which was spent overseas.

Present Illness.—While in France he had influenza and pneumonia followed by nervousness, weakness, dyspnea on exertion and rapid heart action. Examination revealed no organic heart lesion or other physical cause for symptoms. The patient appeared to have considerable insight, attributing his disability to influenza and pneumonia. After several months of treatment he was restored to duty.

As already stated, five cases were diagnosed as "hysteria." The patients were between 20 and 32 years of age; all but one were single, and all were white men. Three had served overseas. Among the symptoms noticed were weakness and numbness of the extremities, tremors and anesthetic areas, all without an organic basis. All of the patients were regarded as having been disabled in line of duty. Two were recommended for discharge, the others remained under observation and treatment in general hospitals.

The following patients suffered from weakness and numbness of the right hand and arm which ushered in an attack of influenza.

CASE 12.—*History.*—Private J., aged 23, single, a farmer. English, had a negative family history so far as could be ascertained. Information was meager. He reached the fifth grade in school. He was not addicted to the use of alcohol or drugs. He served two months in the United States and four months in France.

Present Illness.—While in France, in October, 1918, he had an attack of influenza which was ushered in by weakness and numbness in the right hand and arm. This weakness and numbness continued a number of months, the soldier being still under special treatment in a general hospital in this country in February, 1919. He was quiet and well behaved, showing no intellectual defects or organic physical conditions to account for his symptoms. He said that electrical treatment which he received in France had benefited him greatly.

Several soldiers who had been in the army for some time and had apparently been able to give satisfactory service or who at least had not been brought to the notice of medical officers for inability to carry on their work, were found to belong to a group disqualified for service by reason of chronic and long existent neuropsychiatric conditions. This disqualification had apparently not been realized or perhaps not brought to notice until the men had contracted influenza and had been under close observation in a hospital ward. Among these patients were two cases of constitutional psychopathic state, one diagnosed "emotional instability," the other "inadequate personality."

CASE 13.—The former a single white man, aged 21, a private, had served a total of two years in the army, eight months of which had been in France. Prior to army service, he had worked in many different positions, frequently changing for no definite reason. While in the army, he was absent without leave a number of times and was unable to adapt himself, being continually in conflict. Following the attack of influenza, his restlessness appeared to be aggravated and he was finally recommended for discharge from the army.

CASE 14.—The patient with "inadequate personality" was a private, 28 years old, single, formerly a laborer, who had had ten months of service, six months overseas. During an attack of influenza in France, he had considerable delirium with periods of marked excitement. Following his return to the United States, he had difficulty in remembering and there seemed to be some "thought-blocking" which he appreciated, attributing his disability to influenza.

Two other cases were those of patients with mental deficiency of the moron grade.

CASE 15.—A private, white, single, 30 years old, formerly a farmer, with a total of eight months' service, seven in France, during which he had influenza, showed mental dulness and emotional instability. By the Stanford-Binet test, his mental age was 7 years and 9 months. He was recommended for discharge from the army, not in line of duty.

CASE 16.—A private, white, single, aged 26 years, formerly a teamster, had been in the army fifteen months, eight of which were spent overseas. Following an attack of influenza with pneumonia and pleurisy, he was very weak

and depressed; later, as his physical conditon improved, he became rather boisterous and happy. A psychometric examination made his mental age 10 years and 4 months. Perhaps a modified diagnosis, such as a manic-depressive episode, should be considered in this case.

There were two cases of paralysis of the facial nerve, one of both sides, the other of the left side, which seemed to be quite definitely associated with attacks of influenza. Both soldiers made good recoveries and were returned to duty.

Two soldiers developed neuritis, one during an attack of influenza, the right brachial plexus being affected, the other, two weeks following the influenza, had neuritis of the right peroneal nerve. In connection with the brachial neuritis the chief symptom was weakness of the right arm accompanied by diminished reflexes and some pain or pressure over the nerve trunks and muscles. The disability in the other case was greater. The patient could not lift the right foot from the floor for about two months; weakness of the leg persisted still longer. There was general weakness in the right leg, accompanied by tingling and inability to raise the foot (foot drop).

There were two cases of cerebral embolus associated with influenza.

Case 17.—A recruit, who had been in the service only a short time, aged 21, single, a farmer, had no history or evidence of syphilis. He used alcohol moderately. Subsequent to a period of unconsciousness from an attack of influenza followed by pneumonia, he complained of weakness of the entire left side of the body and difficulty in using the left arm and leg. All deep reflexes were exaggerated, those on the right side markedly so, and there was left ankle clonus. The gait was typically hemiplegic. Sensation was unaffected.

Case 18.—The second case was that of a private, 26 years old, single, a farmer, who had been in the service three months. Twenty days after the onset of influenza and ten after pneumonia, he developed paralysis of the right arm and leg, with inability to talk. The paralysis was spastic, the deep reflexes being markedly increased; abdominal reflexes were absent on the right side; there was a suggestive clonus of the right ankle. The Babinski reflex was not present. Sensation was blunted on the entire right side.

The tremor in a case of hyperthyroidism was reported as being "increased by army life and the after-effects of influenza. Accompanying this tremor was a general nervousness elicited by any physical or mental stress, with rapid heart action."

COMMENT

Considering the large number of cases of influenza occurring in the army during the epidemic, it is somewhat surprising that more instances with a possible influenzal etiology were not found among the 70,000 neurosychiatric cases reported to the Surgeon-General. This would seem to indicate that mental and nervous complications of influenza, severe enough to require the attention of specialists in neuropsychiatry,

were comparatively rare. It is generally conceded, however, that some degree of nervous or mental complications, such as slight neurasthenic or depressive symptoms, are rather common, but do not usually outlast the influenza process.

No attempt has been made to revise diagnoses after a critical consideration of the case histories. In fact, a majority of the records contained sufficient descriptive data to warrant a continuation of the diagnosis reported and all cases were examined, classified and treated under the supervision of competent neuropsychiatrists.

CONCLUSIONS

1. Among over 70,000 neuropsychiatric cases reported to the section of neurology and psychiatry in the office of the Surgeon-General, in only 73 could influenza be deemed a significant etiologic factor.

2. Thirty-two cases belonged to the infective-exhaustive-toxic group, nineteen were psychoneuroses, four manic-depressive psychoses, seven dementia praecox, four neuritis and seven miscellaneous.

3. The infective-exhaustive-toxic types presented delirious features and other symptoms indicative of a severe general reaction with a favorable outcome as a rule.

4. Several of the dementia praecox cases had apparently been normal mentally until the attack of influenza which seemed to be a definite etiologic factor.

5. The manic-depressive cases presented no unusual features.

6. Neurasthenia was the most frequent psychoneurosis, with the characteristic fatigability or feeling of weakness.

7. Influenza appeared to be a definite factor in bringing out or emphasizing difficult personal peculiarities in men who had previously been able to attend to their duties.

8. The neurologic conditions associated with influenza were paralysis of the facial nerve, neuritis and cerebral embolism.

SIGNIFICANCE OF FACIAL PAIN IN DETERMINING THE LOCATION OF INTRACRANIAL TUMOR*

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Pain and anesthesia of the face preceding the onset of deafness possess a significance that is not always appreciated. These symptoms are usually caused by a tumor involving the gasserian ganglion. Neoplasms of the gasserian ganglion invariably give rise to pain or cause objective disturbances of sensation; these symptoms appear early and precede the onset of deafness, or at least they are manifest before deafness becomes discernible.

The gasserian ganglion lies on the anterior surface of the petrous portion of the temporal bone, and is, therefore, situated within the middle cranial fossa; it is separated from the posterior fossa by the dura, which is firmly attached along the crest of the petrous portion of the temporal bone. Furthermore, the ganglion is enveloped above and below by the dura itself. For these reasons fibromatous tumors growing from the acoustic nerve in the cerebellopontile angle generally give rise to deafness as an early symptom and are not prone to extend far enough forward to encroach on the structure lying within the middle cranial fossa.

I have been unable to find records, drawn from reliable sources, of a single case of tumor arising from the cerebellopontile angle in which disturbances of hearing did not constitute an early sign. If this symptom does not occur at some time during the course of the disease, the diagnosis of tumor in the cerebellopontile angle is rendered extremely doubtful.

In an article on intracranial tumors published in 1916,[1] I referred to the importance of ascertaining the exact order in which symptoms arise in cases of intracranial tumor, and called attention to the fact that at times a particular type of tumor is encountered that grows from the dura at the base of the brain in the middle and posterior cranial fossa, frequently involving the bones of the skull; it does not infiltrate the brain substance, but does involve the cranial nerves. Tumors of this type are generally endotheliomas and are occasionally associated with cystic formations. They may arise from the region

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*Read at the Forty-Sixth Annual Meeting of the American Neurological Association, June, 1920.

1. Cadwalader, W. B.: Intracranial Tumors, J. Nerv. & Ment. Dis. 44:11 (July) 1916.

of the gasserian ganglion and extend back, appearing as a flat, slowly growing mass, subsequently involving the seventh and eighth nerves, giving rise to symptoms that resemble those of true fibromatous tumors, which spring from the eighth nerve in the cerebellopontile angle. Unlike these tumors, however, pain in the face is a conspicuous symptom.

Owing to the tendency of these tumors to infiltrate the temporal bone, attempts at removal can hardly be attended with success.

REPORT OF A CASE

The case report presented is instructive because it tends to confirm the correctness of the deductions made from my former observations. Pain in the face followed by anesthesia, or anesthesia dolorosa, in the fifth nerve distribution was the most striking clinical symptom, and proved to be the most important localizing sign. Tinnitus and partial deafness developed later. Symptoms of intracranial pressure were absent. A diagnosis of intracranial tumor growing from the region of the gasserian ganglion was made. Operative treatment was considered, but in the light of experience was deemed inadvisable, because it would probably be impossible to remove a slowly growing, flat tumor mass, which is likely to be intimately connected with the meninges at the base of the brain in this region.

At necropsy the growth was found to occupy the suspected area: the tumor had embraced completely the root of the fifth nerve, and had extended downward and backward almost to the foramen magnum; it had also involved the temporal bone. The brain was not affected directly. Microscopic examination revealed the characteristic appearance of a chondroma. The cause of death was miliary tuberculosis.

History.—Mrs. A. K. was admitted to the University Hospital, Aug. 20, 1919, complaining of attacks of severe pain in the left side of the face. She stated that in February, 1919, she was suddenly seized with severe pain that involved the entire left side of the head and the middle and upper portions of the left side of the face. The pain did not extend to the chin, upper lip, tongue, or the inside of the mouth. The attacks of pain were infrequent during the day, but at night the paroxysms increased in frequency so that the patient had much difficulty in securing sleep. During the next few months the pain gradually became less severe and the attacks grew less frequent, until June, 1919, when it ceased entirely, but was replaced by a peculiar sensation, limited to the previously painful area, and described by the patient as a "running up and down sensation," or a feeling as if ants were crawling over the face. This was constant and particularly marked in the malar region. Occasionally these abnormal sensations became most intense and were accompanied by a feeling as if the mouth were drawn to the left; actual pain was also complained of. Later the patient described the pain as being "burning" and "sticking" in character, and involving, in addition, the left half of the tongue. Not long after the pain set in the patient complained for the first time of a roaring sound in the left ear. This increased in intensity and in June, 1919, it had become so constant as to be extremely annoying and distressing.

Examination.—Examination on admission disclosed the fact that the pupils were small but equal in size and contracted normally to light and in accom-

modation. The media were clear, and the disks oval and normal in color and outline. No fundus changes were apparent, and no extra-ocular palsies were present. None of the muscular movements of the left side of the face could be as well performed as on the right side. There was a decided weakness of the left facial muscle, but the paralysis was incomplete. Cutaneous sensation for touch, pain and heat was greatly diminished, but not completely lost in the entire distribution of all three branches of the left trifacial nerve. The conjunctiva and corneal reflexes were nearly absent on the left and normal on the right side. The motor branch of the left fifth nerve was also affected, for the left temporal and masseter muscles were distinctly weaker than the right. Hearing was reduced. The bone conduction was far better than the air conduction. The right ear was normal. A vibrating tuning-fork placed on the midline of the skull was heard better with the right ear. The upper and lower limbs and the tendon reflexes were normal.

A subsequent examination, made less than a month before the patient's death, showed that general weakness had increased greatly; the patient was confined to her bed, lying generally on the left side. She was stuporous, but could be roused. A constant buzzing in her left ear and a sensation of vibration in the head were complained of. Headache was not severe. The left external rectus was completely paralyzed. The left eyeball was more prominent than the right. The anesthesia of the left side of the face had not changed. Four days before death the patient complained greatly of tinnitus, and was almost, but not completely, deaf in the left ear. The tendon reflexes were increased. She died Dec. 5, 1919.

Postmortem Examination.—On the upper aspect of the petrous portion of the temporal bone there was a swelling firm in consistency and grayish in color. It extended from the apex of the petrous bone for a distance of 2.5 cm. toward its base, and from the sharp edge of the bone 2 cm. into the temporal fossa. Nowhere was the tumor elevated more than 2 cm. above the bone. Immediately under the surface of the temporal bone, near its apex, there was a tumor of similar gross appearance, but measuring 12 mm. in length and 10 mm. in its greatest width; this tumor extended about 4 mm. above the surface. A similar swelling the size of a split-pea was found at the extreme lower border of the petrous bone, half way between the extremity and the base. The dura mater was slightly adherent to the lower border of the temporal bone, the adherent area being about 10 mm. in diameter. On outward inspection a slight flattening of that part of the left temporal bone that overlies the left petrous bone was visible, but otherwise no external changes in the brain were evident. Springing apparently from the left petrous bone was a tumor elevated about 3 mm. above the bone surface; it appeared to be well circumscribed, and extended from the apex to a point midway between the apex and the base, and from the anterior edge of the petrous bone to the foramen magnum below. The tumor measured in detail: The section of the growth on the anterior portion of the petrous bone was 25 mm. in length and 20 mm. in width, and was roughly quadrangular; the portion of the tumor on the lower surface of the petrous bone was also roughly quadrangular in shape, and measured 40 mm. in length and 32 mm. in width. Near the apex of the petrous bone the tumor was somewhat more prominent and assumed the shape and size of a bean. The fifth nerve made its exit from the tumor mass. The growth was of a pale, grayish-white hue and was firm in consistency. It extended almost to, but did not quite touch, the pituitary body.

The tumor invading the surrounding bone was chiseled out, and it was found that the neoplasm extended into the antrum, where a firm, whitish, cartilaginous growth, about the size of a hazelnut, was found.

ENDOCRINAL DEFECTS AND MENTAL STATES

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A recent article by Kempf [1] on "The Tonus of Autonomic Segments as Causes of Abnormal Behavior" says "The ascent of man from a relatively simple organism (the embryonic cell) that is, a complete autonomic apparatus, which specializes into systems and gradually develops a striped muscle or projicient apparatus, naturally divides the matured organism into an autonomic apparatus and its projicient apparatus. The autonomic apparatus is constituted of the organs and ganglionic nervous systems which regulate the assimilation, conservation, transformation, distribution and use of the energic products which are necessary to sustain and promote life and the elimination of the waste products. . . . The projicient is constituted of the skeleton and striped muscle systems, the exteroceptors, the intramuscular proprioceptors and their cerebrospinal nervous systems. . . . At birth we have a well-developed harmoniously reciprocating autonomic apparatus and a poorly coordinated projicient apparatus, but the autonomic apparatus begins immediately to coordinate and exercise control over the projicient apparatus in order to master the environment. This most important factor begins to exert pressure upon the infant at birth and continues throughout its life." Not every instance of such control by the autonomic apparatus has been given physiologic demonstration, but the work of Sherrington is quoted as proving the principle. Kemp says "It is sufficient to know that in a quick continuous intimate manner our autonomic effective tensions influence the general tone of our striped muscle and this tonus by stimulating the proprioceptive system of the striped muscle apparatus, determines the nature of the kinesthetic stream, hence, largely, the content of consciousness. . . . Disturbances in the autonomic apparatus if not readjusted must seriously jeopardize the individual's biological career and self-control in his struggle for life and social esteem."

ENDOCRINAL DEFECTS OF APPEARANCE

This quotation serves as an introduction to a few considerations regarding endocrinal influences on mental conditions as disturbances in the autonomic apparatus are a feature of endocrine control. To put it another way, the person who has a perfect endocrinal balance would show no disturbance of the autonomic apparatus. The endo-

1. Kempf: Jour. Nerv. & Ment. Dis. **51**:1 (Jan.) 1920.

crine chemistry of the individual conditions the autonomic apparatus and that produces the content of consciousness including emotion, and this in terms of perpetuation and external projection is personal character. But there is another point to be thought of, and this phase is the one that I shall speak of chiefly. The endocrine factor not only affects the mental condition or personality through an immediate direct chemical fluctuation by the way of the so-called autonomic segments — such an immediate endocrinal influence as is described in Kempf's analysis — an influence which can be called chemically combustible if one may use that metaphor in order to emphasize the urgency of the situation; but, in addition, the endocrinal factor figures in a static and less direct manner. It does this through the mediation of numerous endocrinological defects, some of which are: gigantism, dwarfism, ungainly length of arms, ungainly proportion of trunk and leg, acromegalic hands or feet, acromegalic features, a cretinoid face, a gerodermic skin, a Froehlich's dystrophy adiposity, a status lymphaticus infantilism, a difiguring facial hypertrichosis in a woman, an underslung jaw, protruding upper teeth, a disfiguring acne, a falsetto voice in a man, a swollen and distorted neck and thyroid struma and even bulging eyes. Such a list may seem bizarre, but I believe it is worth while to make it and to think of such personal features as a neglected source of endogenous factors in abnormal mental states. They become so through being the source of perplexities, doubt, discouragement and feelings of inferiority, and weigh heavily in many transactions of the psyche. I would hasten to add that I do not imply that they are all of equal valence. Some would cause no annoyance in a man, but would be potent in a woman. For example, unnatural height would not disturb the man as much as the woman, and the reverse would be even more definite in the case of unnatural shortness of stature. Also, they would not produce the same mental discouragement at all periods of life. For example, for a young woman a disfiguring facial hypertrichosis can scarcely be overemphasized as a source of gnawing and harmful worry. It probably grows less so as she advances into middle life, but I doubt if it disappears until she is actually in the period of senility. The effect of such a feature is augmented through being the sort of thing which is not talked about freely — it is taboo. The resultant repression and its influence need only be mentioned. Others of the so-called endocrinal defects which I have mentioned bring in these factors of silence, repression and increased affect in a similar way.

ENDOCRINAL DEFECTS OF FUNCTION

Defects of function are also important. They are at the same time dependent on immediate endocrinal influences working through the autonomic segments and on such defects as have been named made

operative by introspection and worry. It is difficult to give examples of such defects of function because most of the examples are complex and clouded by other factors; but an idea of the meaning may be gained by taking as an example the underdeveloped boy. What of the poor record in pursuits in which the boy should excel? Does failure in sports in that stage of his development have no influence on his character? Again, what of the hypo-adrenal asthenic, or the thin-muscled person with status lymphaticus? Does the hypotonia of these types of individuals handicap them in athletic prowess? Does the feeling of inferiority which results from this handicap in an average American community have any bearing on that phase of mental growth which is dependent on deeds accomplished? Inherent physical incapacities cannot always be analyzed, but when they can be, a defect such as hypotonia, which is culled out in the process, may be regarded as an example of what is meant by an endocrinal defect of function. Another example is enuresis in childhood. I must express the belief that there is apt to be a hypopituitary factor in every case of enuresis (hypopituitarism means lack of tone of smooth muscle, and this occasions enuresis). This particular type of endocrinal defect of function is a probable source of grave psychic injury to the child through the reproach, disgrace and openly imputed inferiority which it occasions. I believe the reproach and imputations are the starting point for the majority of the psychogenetic factors found in these persons, and not the psychogenic factors the cause of the average enuresis.

Considered endocrinologically, in the individual it is the repeated and reiterated functioning of things along the lines of the theory of the autonomic segments plus the more static effects that I have endeavored to point out which produce personality. That there are various summated types of personality which are definitely the result of endocrinal predominances can hardly be questioned — such as the thyroid personality, the pituitary personality, and so forth. However, the refinement and description of these personalities will not be attempted in this paper.

ABNORMAL MENTAL STATES CAUSED BY ENDOCRINAL DEFECTS OF APPEARANCE OR FUNCTION

What types of abnormal mental states, if any, succeed the worry and discouragement which is caused by endocrinal defects of appearance or function? I believe they are often found in dementia praecox and psychoneurosis. The figures I have which correlate these two conditions with endocrinal defects are not yet matched by any regarding manic-depressive types. Therefore, I am omitting the latter types. I do not forget that involution melancholia is probably the most clearly

established endocrinal psychosis, but because it does not show the mechanism of conscious worry over a clearly comprehended defect with the injury induced, it will not be included in this discussion. Since it seems preposterous at first glance to mention dementia praecox here when it is a matter of a mechanism involving first, defects, then worry, and implying sufficient insight to make the worry harmful in degree I hasten to add that it is in the stage before the dementia praecox exists that such a mechanism may be at work. In other words, it relates rather to the "shut-in" personality and stands as a conception to explain at least in part what lies back of such a personality. Hoch [2] says concerning dementia praecox, "We see, therefore, that the traits upon which we would lay most stress in the 'shut-in' personality, (are) the lack of contact with the environment, the satisfaction with fancies instead of objective interests, the lack of constructive aims and aggressiveness." There is a suggestive parallelism between these traits and those which would naturally arise if during adolescence the boy lacked normal physical aptness. One type of boy who often lacks such aptness is the flagrantly disendocrinal individual—the status lymphaticus case. Is it not possible that his withdrawal into himself and development of a "shut-in" makeup is a reaction to his endocrinal situation? Amsden [3] has written concerning the traits of the "shut-in" personality in dementia praecox: "The study of many cases convinces one that these traits are developed in relation to a vaguely felt deficiency." An obvious endocrinal abnormality is not apparent in every case of dementia praecox; but neither is the demonstrable "shut-in" personality. I should like to know — and only observation of a long series with the point in mind will tell — whether those cases which lack the "shut-in" personality or the shallowness of interest which, as Kirby [4] has shown, replaces it in some instances, are also the cases in which constitutional endocrinal disturbances, particularly status lymphaticus, hypoadrenalism and hypopituitarism, are not found. Figures regarding status lymphaticus are worth quoting. Emerson [5] found that status lymphaticus occurred in more than 29 per cent. of cases of dementia praecox, and I have found it in 24 per cent. of cases of war neuroses in a series of over 100.[6] As regards the frequent occurrence of this

2. Hoch: Constitutional Factors in the Dementia Praecox Group, Rev. Neurol. & Psychiat. **8**:463 (Aug.) 1910.

3. Amsden: The Study of the Personality in Psychiatric Cases, Am. Medico-Psychological Assn., Seventy-Fourth Annual Meeting, June, 1917.

4. Kirby: Not published.

5. Emerson: A Note on the Incidence of Status Lymphaticus in Dementia Praecox, Arch. Int. Med. **14**:881 (Dec.) 1914.

6. Davis: Status Lymphaticus: Its Occurrence and Significance in the War Neuroses, Arch. Neurol. & Psych. **2**:414 (Oct.) 1919.

among the war neuroses cases, it does not seem surprising that the person with status lymphaticus whose frame was not stalwart, whose muscles were not developed, whose muscles because of a constitutional hypotonia lacked even the potential of normal development, did not stand up under the stress and exhaustion of army life. I do not think one looks for cases of status lymphaticus in college football teams, and men with such cases in the army played "football," to speak metaphorically, not more successfully in France. I would emphasize again the person's awareness of the defect as a factor.

I have recently seen an arrested case of acromegaly in a young man of 28 who now has symptoms of a severe psychoneurosis. This developed only after the acromegaly had reached a disfiguring stage. It has resisted treatment, and this resistance seems to be based on the threatened permanence of the cause of his distress — the acromegalic face. Having had no anamnesis from any one except the patient himself, I can neither bring complete proof regarding his initial makeup nor exclude the possibility that he offered a field for psychoneurotic developments. However, such evidence as we have is quite against that possibility, and his developmental history shows a considerable degree of initial normality. Now he is unable to meet either strangers or old friends; he has several times broken down and cried in public places because there his thick lips and unshapen jaw he feels certain are the cause of unfriendly comment. He shows deep emotion when telling any one of his trouble. He can initiate no plans because his mind is lost in thinking of his affliction; he has no longer the ambition or the confidence natural to him. This case calls our attention, I think, to the defect type of endocrinal influence.

I would like, then, to present the consciously comprehended physical defect as a common factor in the development of both psychoneurosis and dementia praecox, and add that in each up to a certain point, there is a similar mechanism, involving insight, worry, discouragement and alteration of character. True, such a mechanism is far from universal in these conditions, as is the initial defect to initiate it. That sequence in which the worry, discouragement and its bad effects follow in order needs as its preventive education in the fullest sense of that word, so that a philosophizing self-knowledge may be reached. That such a factor as the endocrinal defect should be common to two such conditions as psychoneuroses and dementia praecox rests on the fact that in dementia praecox it is exceedingly early and, one might say, prodromal. I have meant to make that point prominent. In each, other factors enter — in the praecox to complete the estranging and withdrawal and in the psychoneuroses to produce what may be called a combative attitude. In fact, one might distinguish them in terms of fleeing and fighting. While up to a certain point the praecox and

psychoneurotic patients face similar difficulties and receive similar ill effects, the former flees the situation and retreats into a psychosis, while the latter stands and fights, though ever so wildly.

SUMMARY

An attempt at a complete description of endocrinal influences in mental states would be far outside the limits of a single paper. In addition, I doubt whether all the facts bearing on this relationship are as yet known. For brevity's sake, therefore, while I have mentioned the type of endocrinal influence which is immediate and chemical, I have emphasized chiefly static factors based on endocrinal defects of appearance or function, whose bad effects are dependent on insight and discouragement, whose innocuousness is only gained through an educative process forestalling this discouragement. It is suggested that this second type of endocrinal influence is a not unusual early factor in both dementia praecox and psychoneurosis even though these two conditions can be sharply differentiated. In the case of the patient with praecox this reaction to an unsatisfactory and consciously recognized (endocrinal) situation would explain in some instances the "shut-in" personality, and appear to lie back of that makeup. In the praecox patient the subsequent developments amount to a fleeing from this situation, while among the psychoneuroses patients, broadly speaking, there is a wild (psychologic) combativeness and pragmatically less submission.

AN ANALYSIS OF CASES ADMITTED TO THE NEURO-PSYCHIATRIC SERVICES OF U. S. ARMY GENERAL HOSPITAL NO. 1 (COLUMBIA WAR HOSPITAL, NEW YORK)*

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On Nov. 22, 1918, Ward 55 of the U. S. Army General Hospital No. 1, was opened for the reception of neuropsychiatric patients arriving at the Port of Embarkation, Hoboken, N. J., from overseas and also for such cases as developed in the hospitals under the jurisdiction of this port. This had formerly been the Messiah Home and had been maintained for the care of children. It was leased from the directors of the Home by the Knights of Columbus and turned over to the War Department at a charge of $1.00 per year. The general construction was so good that with but a few alterations it was readily adapted for the class of patients with which we had to deal.

The building contained five wards, two of which were devoted to the frank psychoses, one for disturbed patients and the other for quiet, depressed ones. The remaining wards were used for the care of mild mental states, psychoneurotics, epileptics, constitutional psychopaths, etc. The hospital had a total bed capacity of 220. Of this number the ward for disturbed patients contained thirty beds, the ward for quiet patients forty beds, and the remaining three wards contained fifty beds each.

The staff consisted of an executive medical officer, chief of service, five ward surgeons, a mess officer, a registrar and a dental officer. The dentist had a complete outfit and inspected the teeth of all patients admitted. As this part of the general hospital functioned as an evacuation unit, only urgent dental conditions could be treated, but charts were made of all pathologic findings and recommendations for treatment were written thereon. This chart was then forwarded, with the history of the patient, to his final destination. In view of the fact that the unit was an integral part of General Hospital No. 1, we were able to arrange for consultation with the members of this staff and their services were always promptly and cheerfully available. As a result of such an arrangement, many patients actually ill with conditions other than mental could be immediately transferred for treatment.

The hospital was equipped with a complete hydrotherapeutic outfit, consisting of continuous baths, showers, needle spray and douche, etc.

An occupation class under the direction of a trained worker and three assistants completed the therapeutic system.

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* Read before the New York Neurological Society, April 6, 1920.

On admission all patients were immediately inspected for the internationally famous "cootie," venereal diseases and throat infections. Throat cultures were taken on all admissions. Following this procedure, a hot shower was given to all but "cootie patients," who were given a special tub bath. The clothing of all patients was sterilized by steam.

CLASSIFICATION OF PATIENTS

As soon as possible after admission a complete physical and mental examination was made. The cases were classified and reported to the office of the Surgeon at Hoboken, N. J., in order that transportation might be arranged. If the diagnosis on the field card accompanying the patient was not concurred in, the patient was presented at staff meeting and the consensus of opinion determined the diagnosis. In all doubtful cases, blood and spinal fluid examinations were made. In addition, ophthalmic, aural, surgical and medical examinations were made where there were special indications. Where a diagnosis of mental deficiency was in doubt, an intelligence test by means of the Stanford Revision was made and in many cases the diagnosis was changed. This cast no reflection on the work of the psychiatrists overseas, as many of these patients presented a far different aspect after reaching this country. The psychoses patients, too, often presented a far different appearance from that previously noted in their records, and although formerly indifferent and depressed, now presented a cheerful, interested aspect. The total number of patients admitted was 2,750, of which, 2,126 were overseas and 624 were local cases.

The patients admitted to the hospital were classified as follows:

TABLE 1.—CLASSIFICATION OF PATIENTS WITH ORGANIC NERVOUS DISEASES

Amyotrophic lateral sclerosis	1
Sydenham's chorea	1
Acute encephalitis	1
Lateral sclerosis	2
Tabes dorsalis	4
Multiple neuritis (following typhoid fever 1, diphtheria 2, intravenous administration of arsphenamin 1, alcohol 4)	8
Cerebral syphilis	33
Peripheral nerve injury	9
Gunshot wound of the head	2
Head injury without demonstrable fracture of the skull	7
General paresis	61
Fractured skull	7
Brain tumor	3
Progressive muscular atrophy	1
Myotonia congenita	1
Transverse myelitis following intrathecal administration of arsphenamin	1
Nervous disease undiagnosed	2
Total	144

It will be seen from the above that 100 of the 144 organic nervous cases were syphilitic diseases of the central nervous system.

The cases classified as "Observation for Epilepsy" presented no evidence in the accompanying history that a conclusion had ever been observed by a medical officer and as none occurred at this hospital, it was deemed fair to the patient to leave the diagnosis open.

TABLE 2.—Cases of Epilepsy and Observation for Epilepsy

Observation for epilepsy	25
Grand mal	111
Petit mal	9
Equivalents	1
Jacksonian	1
Traumatic	2
Psychosis	2
Total	151

The patients listed under the heading "Recovered" had usually had either a mild depression or excitement of the manic depressive type or else had had an acute alcoholic hallucinosis from which they had completely recovered. A number of psychoneurotics appeared to have recovered in that they were free from symptoms during their residence and so were placed in this group because it was felt that further hospital residence was unwise and might produce a recurrence of their symptoms.

Of the recovered cases the subclassifications were as follows:

TABLE 3.—Classification of Recovered Cases

Psychoneurosis	17	
Alcoholic hallucinosis acute	7	
Manic depressive psychosis	9	
Psychosis undiagnosed	1	
Alcoholism acute	1	
Pathologic intoxication	1	
Delirium tremens	1	
Psychosis following influenza (infective exhaustive)	3	
Undifferentiated depression	2	
Gunshot wound of the spinal cord	1	
Recovered	—	43

TABLE 4.—Mental Deficiency and Manic Depressive Psychoses.

Mental deficiency with psychosis		4
Manic-depressive psychoses:		
Manic type	95	
Depressed type	213	
Mixed type	44	
Circular type	1	
Manic-depressive psychosis	—	353

In the manic-depressive psychoses group, in so far as we were able to obtain reliable information, thirty-five had had a previous attack. It must be remembered, however, that the number of patients who had

had previous attacks was undoubtedly greater, but as many of the patients were entirely inaccessible, information in regard to this could not be obtained. The depressions predominated.

TABLE 5.—Cases of Dementia Praecox

Hebephrenic	256
Paranoid	163
Simple	111
Catatonic	20
Total	550

Many of the patients presented a typical schizophrenic history, but were in an apparently normal condition and well adjusted. Some of them gave quite adequate explanations for their upset, such as nostalgia and worry over misfortune at home. Others stated that they felt they had been unfairly treated in the army. The eventual outcome appeared to be problematical. We felt that the original diagnosis should be left unchanged.

TABLE 6.—Cases of Paranoid Condition, Alcoholic and Traumatic Psychoses, Constitutional Psychopathic State and Psychoneuroses

Paranoid condition		4
Psychoses with somatic disease:		
Following influenza	20	
Following mumps	2	
Following pneumonia	1	
		23
Traumatic psychosis (head injury)		5
Alcoholic psychoses:		
Acute hallucinosis	37	
Deterioration	4	
Pathologic intoxication	1	
		42
Constitutional psychopathic state:		
Inadequate personality	110	
Emotional instability	8	
Paranoid personality	5	
Delinquent tendencies	1	
Homosexuality	3	
Criminal tendencies	3	
		130
Psychoneuroses:		
Hysteria	295	
Neurasthenia	282	
Psychasthenia (compulsion neurosis)	25	
Anxiety state	22	
Hyperthyroidism	8	
Enuresis	8	
Disordered action of the heart	5	
Traumatic neurosis	3	
Stammering	6	
Syphilophobia	2	
Hypothyroidism	2	
Somnambulism	1	
Dyspituitarism	1	
Facial tic	1	
		661

Of the neurasthenic group 26 per cent. of the patients gave a history of having had symptoms of this condition in civilian life and of the hysteria group 19 per cent. gave a history of similar trouble prior to army service.

TABLE 7.—CASES OF INEBRIETY

Alcoholism	111
Morphin addiction	7
Heroin addiction	6
Heroin and morphin addiction	1
Total	125

The small number of drug addictions is noticeable.

TABLE 8.—CASES OF MENTAL DEFICIENCY, WITHOUT MENTAL DISEASE AND UNDIAGNOSED

Mental deficiency:		
Morons	225	
Imbeciles	27	
		252
No mental disease found:		
Rheumatic fever subacute	1	
Flatfoot	1	
Duodenal ulcer	1	
Pulmonary tuberculosis	3	
Syphilitic cirrhosis of the liver	1	
Gastritis, chronic catarrhal	1	
Syphilis, secondary	1	
Acute gonorrhea	1	
Deviated nasal septum	1	
Diphtheria carrier	2	
Malaria, tertian	1	
Polyarthritis, rheumatic	1	
Gunshot wound of the right arm	1	
Valvular heart disease	1	
Diagnosed as epilepsy but not concurred in	1	
No physical or mental disease found	13	
		31
Psychoses undiagnosed		148

The cases with psychoses undiagnosed were left ungrouped because of the lack of data sufficient to make a differentiation possible. Many of these patients were fearful and refused to answer questions. They were not catatonic nor did they attitudinize. Hallucinatory reactions were not observed. Other patients appeared quite confused and presented a dreamlike perplexed state. At times they appeared quite depressed. They refused to cooperate on examination. Many of the patients were difficult to differentiate adequately, and it could not be definitely decided as to whether they presented a praecox or manic depression reaction. In many cases there was an alcoholic history and coloring which was difficult to properly evaluate. In a few of the cases there were pupillary signs, but the residence was too short to permit of blood and spinal fluid examinations, or else they were too disturbed for such procedures.

This part of the U. S. Army General Hospital No. 1, closed officially on Sept. 10, 1919, but no patients were received after Sept. 1, 1919, so that it was open for the reception of patients for a period of nine months and twenty-two days.

COMMENT

1. None of the cases appeared different from those encountered in civilian life, except that most of them had a military coloring.

2. Of the total number of 2,750 patients, 24 per cent. were psychoneurotics, 20 per cent. of the dementia praecox type, 12 per cent. were of the manic-depressive group, 10 per cent. mental defectives, 5 per cent. had organic nervous diseases, principally of the syphilitic type, 4 per cent. were definitely epileptic and 4 per cent. were constitutional psychopaths.

3. There were only fourteen cases of drug addiction, or about 0.5 per cent. of the total admissions.

4. Many of the cases apparently of the praecox type appeared to be recovered with excellent insight.

5. Of the neurasthenic group, 26 per cent. of the patients gave a history of having had symptoms in civilian life, and of the hysteria group 19 per cent. gave a history of similar trouble prior to army service.

A comparison of the group percentages found at this hospital with the group percentages of the total male admissions for the New York State Hospital service during the year 1919, is interesting. During this year the total first admissions were 6,791. Of this number, 3,527 were men. The group percentages for the male admissions are as follows:

TABLE 9.—Classification of Men Admitted to the New York State Hospital During 1919

	Per Cent.	Number of Cases
Traumatic psychoses	0.5	18
Senile psychoses	9.0	324
Cerebral arteriosclerosis	6.0	236
General paresis	20.0	710
Cerebral Syphilis	0.4	15
Organic brain diseases (Huntington's chorea, brain tumor, etc.)	0.5	19
Alcoholic psychoses	5.0	204
Drug psychoses	0.16	6
Psychoses with somatic disease	2.0	76
Manic-depressive psychoses	9.0	352
Involution melancholia	1.5	56
Dementia praecox	27.0	1,001
Paranoia	1.5	59
Epileptic psychoses	2.7	96
Psychoneuroses	1.0	35
Constitutional psychopathic state	1.6	66
Psychoses with mental deficiency	2.5	88
Psychoses undiagnosed	3.9	138
Not insane	0.7	28

While a strict comparison is not possible, it is interesting to know that there is a close ratio between the percentage of cases of dementia praecox, namely, 20 per cent. in the army and 27 per cent. in civilian life, and between the percentage of cases of manic-depressive diseases, 12 per cent. in the army and 9 per cent. in civilian life. Dementia praecox in both instances forms the largest group of the psychoses. Comparisons between the other groups is impossible because the civilian state hospitals deal primarily with psychoses occurring at all ages and with unselected population. In 1918, of the total remaining population in the New York State hospitals, 59 per cent. were of the dementia praecox group. It will readily be seen, therefore, that our great problem, from the standpoint of psychoses, both civilian and military, is that of the dementia praecox group. If it were possible to trace these patients, the eventual outcome would be interesting and might throw some light on this perplexing problem.

Grateful acknowledgment is hereby made to the men who served on this service, for their work and help in classifying these cases.

ADDRESS AT THE DEDICATION OF A TABLET IN HONOR OF DR. CHARLES K. MILLS

AT THE PHILADELPHIA GENERAL HOSPITAL
JUNE 17, 1920

JAMES HENDRIE LLOYD, M.D.
PHILADELPHIA

We have met today to do honor to a friend and colleague whose name will always be associated with the beneficent work which for so many years has been the distinction of the Philadelphia General Hospital. This tablet is the symbol of that association—but it is only a symbol, for the work itself, in its far-reaching influence and effects, is more enduring and more worthy of commemoration than can even be expressed in a tablet of bronze. It is said that Charcot took the chronic and neglected cases of the Salpêtrière, and on his study of those cases helped to lay the foundations of the modern science of neurology. With an insight no less wise and discerning than that of the great French neurologist, did Dr. Charles K. Mills see and grasp the opportunity to have established in this old city hospital a department of nervous diseases, which has won its place as one of the foremost neurological clinics of the world. This suggests our theme—which will be a tribute alike to the hospital and the man.

From the beginning the Philadelphia Hospital had suffered some lack of prestige from being looked on by the public as merely an almshouse. The title, as applied to the hospital, was a misnomer, for Blockley has always been much more than an almshouse; it has been a large general municipal hospital, including in that title also a large hospital for the insane. Not, however, until the formal establishment of free clinical teaching in 1860, and the erection of the clinical amphitheater in 1861, can the present era of the hospital be said to have begun. Before that date, however, as you can read in the late Professor Agnew's historical paper, a long record carries the Philadelphia Almshouse and Hospital far back into colonial times, for this institution, as Dr. Agnew showed, is the oldest hospital in the United States. During that long period it had twice changed its site, until, about 1830, it was located where it now stands; and it had an interesting and checkered career as a seat of clinical instruction. It numbered on its staff some of the most illustrious names in the medical profession in America; it admitted to its wards, on the payment of a good round fee, medical students who came from many parts of the United States; it harbored a great population of the insane,

Bronze tablet dedicated to Dr. Charles K. Mills at the Philadelphia General Hospital. Unveiled June 17 with a dedicatory address by Dr. James Hendrie Lloyd.

some of whom, I regret to say, it kept in cells and straight jackets; it gave birth in its obstetric wards to more than 2,000 children in seven years; it had one of the largest specific services in the land; its medical and surgical clinics were conducted, from pre-Revolutionary days to the days of and after the Civil war, by such men as Bond, Dorsey, Rush, Physick, Gibson, Chapman, Stillé, Penrose, Agnew, Da Costa, Gross, Pancoast, Pepper, Tyson, Wood, Musser, White, Osler and others too numerous to mention; but in all that time it contributed little if anything to neurological science.

It was, indeed, a great hospital—a world within itself; with a population sometimes exceeding 4,000 souls. It was, and is today, one of Philadelphia's unique institutions, with a long history of service to humanity and to science, an honor to the city, the seat of some of the best medical traditions and associations in our midst.

But much of the clinical material gathered within the walls of Blockley was, from the very nature of things, of a most unpromising kind. In its vast population of the indigent, the infirm, the hopeless, there was a great preponderance of chronic and incurable cases. Gathered together from the far reaches of a great city, these chronic patients were the wards of charity rather than the objects of scientific interest. The public conscience was satisfied when it provided for them a last refuge on earth; the public debt was discharged when it gave to the paralytic a cot to sleep on and three meals a day. Whether it was with the inspiration of genius or simply with good, hard common sense, Dr. Mills saw the necessity and the opportunity for the establishment in the Philadelphia Hospital of a special department for nervous diseases. The idea was new, original, so far as this hospital was concerned—and, in fact, so far as any large hospital in Philadelphia or the country at large was concerned, for neurology as a specialty had hardly advanced that far. Weir Mitchell, indeed, had made a fruitful start in the comparatively small Orthopedic Hospital, where he was developing a nervous infirmary which was destined to be associated with his name and work, but the old idea was that a big hospital was naturally divided into a medical and surgical (and possibly an obstetrical) department, for nervous diseases were not *sui generis*—they belonged to medicine, and medicine had never made much out of them in Blockley. It is doubtful whether a good neurological paper had ever been written from this hospital before that time.

It was in 1877 that Dr. Mills won the consent of the old Board of Guardians (by whom the hospital was then administered) for the establishment of a neurological department. He had been appointed neurologist to the hospital in September of that year, the first position

of the kind in Philadelphia and probably in the country. He has the distinction, therefore, of having first won official recognition for our specialty—an instance of his own primacy and the primacy of this hospital in the advancement of neurology.

The first patients—men and women—placed under his care in the wards for nervous diseases were less than twenty in number, and they were brought from various regions of the hospital where they had been receiving little if any attention. But the growth of the service was rapid, until in 1898 the number of patients amounted to more than 500, and in more recent years this number has been maintained or even exceeded. From having had at first only one neurologist, the staff has increased until it now numbers eight members, with eight assistants. The psychopathic department, which is practically an offshoot from the neurological, has also its separate staff.

The neurological department of the Philadelphia Hospital has thus developed into a great special service—and it is not too much to say that it has been in a sense the headquarters of Philadelphia neurology. If there is such a thing as a Philadelphia school of neurology, it is the Blockley school, for without exception all the men in this city now living who have attained distinction in neurology, have served on its staff. It has been the foster mother of the Philadelphia Neurological Society, for without its nourishing aid the transactions of that society would have been small indeed. It has given their earlier training to men who have been called to professional chairs in our various colleges, and supplied many of the themes and illustrations of those whose writings have done much indeed to keep Philadelphia in evidence as a neurological center. As of old, it has been a teaching hospital, and medical students have been initiated here into the mysteries of what is generally conceded to be the most difficult of the specialties. The facilities offered by its wards for the study of organic diseases of the nervous system are unsurpassed in this country, and scarcely surpassed abroad. In 1888, when Dr. Ferrier and Mr. Victor Horsley, both of whom were distinguished for their original work, came to America and visited Blockley, they said it reminded them more of the Salpêtrière than any hospital they had seen in this country.

During the recent great war a school of neurology was established by the United States government in Philadelphia for the benefit of medical officers entering the army and navy, and a large part of the teaching was done in the wards for nervous diseases of the Philadelphia Hospital by members of the staff, or in their clinics in other hospitals.

Graduate instruction has also been given for some years, and the graduate school, which was originally proposed by Dr. Mills, has only recently been practically merged in that of the University.

In its long career the Philadelphia Hospital has sometimes been a storm center of great magnitude. The waves of criticism have rolled over it, but it has usually emerged with renewed life. In these crises no one more than Dr. Mills has stood for improvement, and against any policy of concealment or stand-pattism, but he has also never been slow to champion the hospital. In sympathy with his wise leadership the members of the neurological staff are loyal to Blockley, and have always cultivated an *esprit-de-corps*. All they ask for the hospital is a fair deal. They believe that the work done here, both in neurology and psychiatry, equals if it does not surpass, both in quantity and quality, the output of any other hospital in this city. Our buildings may be old, but our science at least is up to date. Under the recent administration of Dr. Wilmer Krusen, the interests of the hospital have been greatly advanced and we look forward with confidence to a period of improvement under the administration of Mayor Moore and Dr. Furbush, which will advance the hospital to a still higher plane, and will also continue for the neurological department its era of prosperity and distinction which was inaugurated more than forty years ago by Dr. Charles K. Mills.

This is hardly the time or the occasion for an elaborate review of Dr. Mills' work in his chosen specialty. His name is so closely identified with that specialty in this country that an account of the one could not be given without a history of the other. But a fair and candid eulogy need not swell to the proportions of a history, for we are concerned today to link his name and fame with the record of old Blockley rather than to trace his work too far afield. We know how long and faithfully he has served the University of Pennsylvania in the chair of neurology; how he has written a textbook of nervous diseases which bears on every page the impress of his wide knowledge and experience; how he has contributed to medical literature more than two hundred special papers on all phases of neuropathology; how he has enriched the proceedings of our various medical societies and been honored with membership in learned societies abroad. In medical jurisprudence he has an established reputation in our courts; in consultation, a high repute whether at the bedside or the council board. All these are the evidence and the fruitage of a long career devoted to the advancement of neurological science.

But in our gathering here today, in our dedication of this tablet, there is something more in evidence than a mere impulse to do honor to the physician and the scientist. We pay our tribute of affection to the man. Our colleague, our friend, our chief, we salute and applaud him.

News and Comment

AMERICAN GIFT TO THE SOCIÈTÈ DE NEUROLOGIE

At a recent meeting of the Société de Neurologie de Paris, according to *The Journal of the American Medical Association*, the secretary-general read a letter from Dr. Hugh T. Patrick, Chicago, a foreign corresponding member of the society, in which the writer expressed his admiration for the work of French neurologists during the war and enclosed a check for 10,000 francs to help the society in continuing the publication of its transactions. The society unanimously voted its thanks to Dr. Patrick for his aid to the diffusion of its works, and expressed the hope that he, together with the new American members, would attend the next annual Réunion neurologique at which collaboration could be established between neurologists of France and the United States. This reunion will be held July 9-10. Only one subject will be discussed: "The Clinical Forms and Treatment of Syphilis of the Nervous System." The titles of discussions and the names of those who anticipate being present should be communicated to the secretary-general, Dr. Henry Meige, 55 Rue de Grenelle, Paris.

Abstracts from Current Literature

LE SINERGIE RIFLESSE SPINALI (SYNERGIC SPINAL REFLEXES). OBSERVATIONS ON SPINAL CORD INJURIES. Lodovico Gatti, Riv. di patol. nerv. **24**:165 (Sept. 13) 1919.

This extensive, well written article of fifty-five pages is divided into six chapters. The bibliography is large. It is carefully abstracted so as to make it available in English.

1. *History of the Physiology of Spinal Reflexes.*—The first chapter deals with this subject and is an extensive review of the literature. The first knowledge of the automatic functions of the spinal cord is due to the discoveries of Prochaska in 1784. Next come Vulpian and Brown Séquard and until recently these studies were limited to the physiologic laboratories and resulted from experiments on animals, the most important of which were done by Sherrington. These experiments, however, were brought into the field of clinical medicine by Pierre Marie. Sherrington's experiments on the cat illustrating decerebrate rigidity in the prepared animal are not influenced by section of the posterior columns of the cord, relaxation only being induced by section of the lateral columns below the decussation of the pyramids. Mention is also made of the fact that the rigidity involves only the extensors of the body, the flexors being only mildly tonic, the tonicity not being influenced by cord section. Excision of the cerebellum and the labyrinths, while diminishing the rigidity, does not abolish it. The rigidity is not abolished even if all the nerves of the skin and the other muscles except the extensors are cut; only when the nerve to a muscle itself is cut does relaxation take place, or when the posterior roots supplying that muscle are severed. This tonic influence is attributed by Weed to the red nucleus. Sherrington's observation that the tonicity is limited to posture maintaining muscles only is recalled. This is the postural or static reflex.

This static reflex is found to apply inversely, however, to the flexors as shown by Brondgeest in the spinal frog whose erect attitude is maintained by flexors. Sherrington's law of contraction of the posture maintaining groups and relaxation of the antagonists is discussed in relation to the static reflex. The work of Magnus and Kleyn support these views. Flexion of the head of the decerebrate cat decreases the tone of the extensors of the forelimbs and increases the tone of these in the hind limbs, whereas in bending the cat's head backward the reverse is true. The authors attributed this to stimulation of the proprioceptive nerves of the neck and of the vestibular mechanism, as destruction of the labyrinths and immobilization of the neck or cutting of the cervical roots have demonstrated. These authors also noted the unilateral head and trunkal synergy depending on these facts in the prepared cat. These facts have been corroborated by P. Marie in the hemiplegic patient and by Magnus and von Kleyn in normal men. When the head is inclined to 45 degrees below the horizontal level (the subject lying flat) the extensors of the legs show tonic increase which is decreased when the head is turned 160 degrees from this position. This can be demonstrated less actively, however, in children up to 3½ months old. In the prepared cat the static reflexes

are inexhaustible and these muscles show the same tonic status whether they are lengthened or shortened in the act of maintaining posture.

According to Sherrington, therefore, there are two systems innervating muscle, one the static reflex residing in the midbrain and the other the flexor having essentially a phasic action mainly of protection, which is purely an inherent spinal cord function. The work of Bayliss, Uexküll, Parnas and Sherrington seems to show that there are actually two groups in the musculature of animals, one of phasic movement and the other static. These authors demonstrated this fact chiefly in bivalves. In vertebrates, however, purely static muscles are not found except possibly an analogous group in the smooth sphincters. In vertebrates, Botazzi assigns this dual rôle to the musculature, the sarcostiles being the contractile element and the sacroplasm the tonic. Perroncito and Boecke, Mosso, Van Boer and Langeaan have discovered a double innervation of striated muscle, one from the anterior horn cells and the other from sympathetic nonmyelinated fibers probably having to do with tonic impulses.

The writer calls attention to the works of Negrin, Lopez and von Bruecke who found that extirpation of the abdominal sympathetic does not produce a lasting atonia of the musculature of the same side. All these experiments unite to show that while decerebration reveals an automatic static tonic mechanism, this cannot be compared to the tonus of voluntarily contracting muscles, which exist in all normal persons. These static reflexes have also been demonstrated in normal cats and in man.

The author made his study because of the meager records of static reflexes in man of mesencephalic origin. In order to differentiate these from the phasic reflexes, he reviews our knowledge of the latter. For the phasic reflex studies the spinal animal must be used, despite the fact that in decerebrate animals the extensor hypertonus overshadows the phasic flexor system. In spinal animals, therefore, a painful stimulus applied to the hind legs causes a prompt retraction in all of their segments; the flexion reflex of Sherrington. Any part of the leg is a reflex zone except the nearest proximal portion to the stimulus which often shows a homolateral extension reflex, or the contralateral limb will show extension—the crossed extension reflex. If instead of nociceptive, mild stimuli are used, rhythmical reflex phenomena are demonstrated; in addition to the flexion reflex in the stimulated limb, one sees a crossed extension reflex or a flexion reflex of the contralateral foreleg with extension of the homolateral limb. With the limbs in this position the contraction formula now becomes inverted into a series of rhythmic movements reminiscent of the walking movements; the walking or running reflexes. Nociceptive stimuli inhibit these, but if such a stimulus is applied producing the flexion reflex and continued, the walking or running reflexes may be produced in the contralateral limbs. The rhythmic reflexes can also be produced by stimulating the cord itself electrically in the spinal dog. The scratch reflex can also be produced by stimulating the skin of the back and neck, the hind leg of the same side being used in rhythmic attempts to brush away the stimulus.

2. *The Synergic Pathologic Reflexes in Man.*—The author prefers with Kroll and Biondi to call these synergic reflexes rather than by any interpretative name such as Babinski's term "reflexes de defense" or Marie's "reflexes d'automatisme medullaire." In ordinary spastic paraplegias a painful stimulus applied to the foot produces the flexion reflex of the spinal animal. This is best obtained by forced passive plantar flexion of the toes

(P. Marie). Where this appears spontaneously, however, Babinski believes it is due to visceral stimulation. It has been known to occur during defecation, and Marinesco and Noica have seen it follow forced inspiration and coughing. Normally the movement of retraction of the limb with plantar flexion of the toes occurs in response to painful stimuli in man, and Babinski holds that obtaining this response by stimulating any part of the limb except the plantar surface, is pathologic, providing one gets besides flexion of the limb at all three segments, dorsoflexion of the big toe.

The Sensation of the Flexion Reflex in Motor and Sensory Paraplegics: Claude noted the subjective sensation which accompanied this movement in absolutely anesthetic paraplegic patients. The sensation is referred to the stomach and accompanied by a grimace. The author noted that this occurred only in those cases in which the flexion reflex causes trunkal motion. It was noted in patients with the anesthetic sensory levels not much higher than the umbilicus, in patients with anesthesia to the tenth dorsal vertebra, and only when the stimulus was painful enough to cause abdominal contraction. The factor of compression of the diaphragm caused by compression of the visceral mass enters into this, aside from possible obscure visceral sensory factors.

Extension Reflex: This is much rarer than the flexion reflex. All segments of the limb extend with plantar flexion of the toes. The reflexogenous zone may extend to the perineum or the loin or higher but in these cases the thigh may belong to a reflexogenous zone giving the flexion reflex instead of the extensor.

Crossed Reflexes: These are as described above, except that they are seen in the contralateral limb. Most commonly one sees the flexion reflex on one side with plantar flexion of the toes and foot of the opposite foot. This must not be interpreted as a crossed plantar flexion but as an abortive crossed extension reflex. At times, Walshe and Sherrington have noted the flexion rebound after a crossed extension reflex. Dorsiflexion of the big toe, however, is part of this rebound. The author believes that this is caused by the expansion of the flexor muscles in the extensor thrust causing a reflex in flexion by rebound. The inhibition of antagonists is illustrated in the extension reflex and is illustrated further in the study of clonus. With patellar clonus, the limb being placed in flexion, the clonus is increased in the opposite knee and diminished in the flexed limb.

Rhythmic Reflexes: The author has never seen them in his cases. Marie obtained a homolateral alternating flexion extension reflex by faradic stimulation of the skin of the inner thigh and a contralateral one by provoking a flexion reflex.

3. *Babinski's Sign and the Flexion Reflex.*—The regularity with which the triple retraction of the limb occurs with dorsiflexion of the big toe has led Marie and Foix to say that the Babinski reflex is part of the flexion reflex to which Babinski objects. Marie believes that the triple reflex retraction and the Babinski sign are automatic movements seen normally in the walking biped, and naturally plantar flexion of the toes occurs during the extension reflex because in walking when the limb is extended, the plantar flexors contract to clutch the ground and thus aid progression. According to Marie, the Babinski response is the minimum response to plantar excitation, a stronger stimulus being necessary for a flexion reflex response. The author describes two cases in which the Babinski response coincided with a lengthening of the limb giving an appearance of synergy between these two movements. He

says that he dealt in these cases not with an extension reflex because every stimulus increased the extensor spasm, and that this spasticity opposed the usual reflex because the extensors contracted more strongly. The dorsiflexors, while normally stronger, became less dominant because in the extreme extension of the limb due to the spastic paraplegia the points of their insertion were lengthened while the plantar flexors shortened theirs and made this movement mechanically easier.

The author agrees with Walshe that the Babinski is not the minimum motor response to plantar stimulation because by palpation the flexors of the leg were felt to contract more strongly in this test. That the dorsiflexion of the toe is more evident is due to the fact that the extensor longus hallucis has only to move the big toe while the flexors of the leg have a larger task. This contradicts Marie's views that the Babinski represents a minimum motor response to reflex stimuli. The author thinks that it is simply an expression of the reflex activity of the muscular group which is typographically the lowest in the flexor system. He relates a case in which a few days after injury the Babinski sign occurred alone and only on one side with mild contraction of the hamstrings. For a few days all voluntary movements, except that of the extensor hallucis, had disappeared in the extremities. While it is difficult to discover why all except this one muscle were paralyzed, the fact remains that the complete paralysis and areflexia showed that apparently a general inhibition of all spinal motor apparatus existed except in the extensor hallucis, making it possible to observe the flexion reflex essentially localized to this one muscle. The Babinski response does not accompany the flexion reflex only in rare cases, and some of these are caused by contractures in plantar flexion of the toes due to the weight of the bed clothes causing a pressure ankylosis and contractures, thus making dorsiflexion of the big toe impossible. As Walshe points out, the same thing may happen when there is contracture of the extensor hallucis less marked than in the proximal muscles of the leg, the marked dorsiflexion of the foot masking the mild dorsiflexion of the big toe. The author then cites Cases 5, 6 and 7 as examples of dissociation in the flexion reflex due to disturbances of nutrition in the cord because of infection and trauma. He believes that the Babinski sign was not obtained because the response was not a true flexion reflex, the movement occurring in the adductors of the leg. The reflexogenous zone was not in the foot as is customary with the flexion reflex but in the inner side of the thigh, the genitals and the perineum. In these patients even a light stroke of the pin caused a sharp adduction of both adductors and the glutei and retraction of the arms. These were the only muscles to respond. The author believes that here we deal with a true closure reflex such as would normally oppose the entrance of anything near the perineum, and not an incomplete flexion reflex.

Clinical Experiences with the Babinski Phenomenon: When the leg is flexed on the thigh, the patient lying face downward, the Babinski sign will often be substituted by plantar flexion of the toes; but this occurs only when the Babinski phenomenon is present to a moderate degree, for where this sign was marked and other synergic reflexes were present the author could not make the Babinski reflex disappear by placing the patient in the above attitude. In assuming this position there is a relaxation of the flexors and a tautness of the extensors of the leg, those of the foot not being influenced. The author, by overflexing the leg on the thigh in the prone position, was often able to cause the Babinski reflex to disappear and reappear by extending the

leg a little. He points out that these movements are practically the only function of the lower extremity in walking in contrast to the varied functions of the hand and fingers. Necessarily, therefore, there must be an intimate synergic association between the flexor and extensor groups of cells in the cord for the performance of this automatic function, analogous to the system of oculogyric and cephalogyric movements. So one finds that the rectus femoris muscle in the superior portion is part of the flexor system while the remainder is an extensor. The lower end of the quadriceps, the gluteus maximus and the posterior muscles of the legs are extensors, but the psoas, anterior rectus, sartorius, gracilus, pectineus, the adductors and the tensor fasciae, the hamstrings, tibialus anticus and the extensors of the toes are the flexors, according to this grouping. There is a tonus synergy between these groups clinically proved by the fact that stimulating the (Babinski test) flexor system inhibits the extensor groups (patellar clonus). The author, experimenting on paraplegics with complete anesthesia to eliminate the painful element of the stimulus, was able to show in nineteen out of twenty-one paraplegic soldiers that causing a strong extensor contraction by faradization of the anterior crural nerve, a strong faradic stimulation of the plantar surface of the foot failed to produce an extensor response of the big toe (Babinski sign). If instead of the anterior crural the obturator was stimulated, the Babinski reflex was obtained. Strong currents must be used on the nerve and not the muscles to obtain this phenomenon. This the author feels shows the intimate connection of the Babinski reflex with the flexor group, as does also the fact that often passive extension of the foot on the leg will cause the extensor big toe response as will also the mere raising of the heel above the bed passively. In these movements the stimulus caused by stretching the posterior leg and thigh muscles is enough to produce a flexor response in all three segments of the extremity if the paralysis is profound enough (automatism of cord) but in milder cases the response of the extensor hallucis is obtained (Babinski sign) alone as part of the flexor response. In testing these points on patients the author warns that too large an area must not be exposed to stimulus because in certain cases the Babinski sign may be elicited by pinching the cheek or the ear. The patients should rest on a firm, flat bed, all points of contact with the body removed (bed clothes), the room should be warm and care must be taken in the passive muscular movements not to stroke or otherwise irritate the skin. The organic reflexes of the patients must also be discounted for a distended bladder or rectum will often cause the Babinski response independently of any other stimulus.

4. *Physiologic Significance.*—The author believes that the flexion reflex has not the same significance as the rhythmic reflex (running) because a single painful stimulus produces the first while continued mild or painful stimuli are necessary to bring out the latter. Marie does not believe the flexion reflex is a defense reflex but the author objects to Marie and Foix's views that it is an expression of "spinal stepping," i. e., a phase of gait more particularly because if this were true then extension of the limb should precede flexion as occurs normally in animals. As the plantar surface of the paw touches the ground, the toes are in plantar flexion but the limb is in extension. The author admits that some examples of initial rapid extension of the limb occur before the flexor response in man or only a plantar flexion of the toe precedes the flexion reflex with dorsiflexion of the toes, but usually the response is suddenly flexor alone and cannot be a synergic walking phasic response to plantar stimulation. Babinski, Walshe, von Woerkom and others,

however, think the flexion reflex is purely defensive. They admit the difficulty of explaining it as a defense reaction when provoked by stroking the chest or abdomen, but they say the same objection holds good for those who insist it is a walking reflex. They insist that no matter how wide the reflex zone may be the plantar surface of the foot has always the lowest threshold for the stimulus, therefore the flexion response always has a certain protective quality. The author does not believe either explanation is complete. He feels that the stimulus arriving in the anterior horn cells of the automatic spinal animal diffuses through various groups of cells awakening an automatic synergic response which may be a habitual response to serve any one of several ends. There is no specificity of purpose about the response, it is only a movement. The animal flexes his limb in walking and in withdrawing it from painful contact and the child in his first days does the same purposelessly. The fetus assumes this position. In other words, if the rhythmic reflexes are ambulatory responses, the closure reflexes defensive, the synergy between contraction of the bulbocavernosis and flexion of the legs is a sexual reflex; the retraction of the lower extremity represents, therefore, not an action but a phase in the completion of one, which may be the running reflex synergy or something else.

Regarding the Babinski response, it is necessary to say that the upper extremity has many movements of cerebral origin, the lower being almost wholly limited to automatic extensor and flexor movements at the three joints comparable to what is seen in the animal; therefore these movements, when the control of the cerebrum is cut off, remain as the automatic function of the spinal cord as determined by habit and phylogenesis. In man, however, the development of the cerebrum has reached such a state that the automatic synergic reflexes in the cord cannot be compared in extent and number to those found in the spinal animal. The author who has observed many hundreds of spinal cord injuries as a result of the war, has never seen the rhythmic reflex (running reflex) and only rarely the crossed extension reflex.

5. *Cutaneous Reflexes: The Bulbocavernous and Sexual Reflex.*—The cutaneous reflexes are analogous to the synergic and appear more as reflex movements adapted to defense. These reflexes are not cortical, however, for transverse lesions of the cord have been described with their retention although, as Sherrington has shown, the cortex inhibits them. The cutaneous reflexes are spinal and have a phylogenetic habitual significance. The author looked for Onanov's sign in all his cases. It is obtained by stimulating the skin of the scrotum or the penis, the bulbo and ischio cavernosi being felt to contract in the perineum (S3) and accompanying this other muscles, chiefly the levator and sphincter ani, contract. Usually this reflex disappears with impotence due to old age, tabes, etc. The author found it persisted in severely injured soldiers, even when there was complete paraplegia with anesthesia and retention or incontinence, providing the prepuce and glans were sufficiently stimulated. It is not a priapism due to vasomotor paralytic stasis in the corpi cavernosi, such as is seen in some complete transverse lesions of the cord, but a real erectile contraction. In one nearly complete severance at the sixth dorsal level (operation) with paraplegia, anesthesia, bed sores, flexion reflex with Babinski sign (bilateral) areflexia and incontinence, the bulbocavernous reflex was obtained even by pricking the skin of the anus, perineum and gluteal region. In many cases this reflex was accompanied by contraction of the biceps (flexion and rotation of the limb and eversion of the leg). In only two of 150 cases showing the bulbocavernous reflex was this contraction of

the biceps absent, and when the biceps contracted strongly the semitendinosis and semimembranosis also often contracted. This, however, is not a pathologic reflex because it was found present in 60 per cent. of normal soldiers of from 20 to 30 years of age. However, in the normal man the response is less active, the stimulus must be frequently repeated and is easily exhausted and the contraction of the other hamstrings is never seen. A unilateral absence of this reflex is seen in sciatica. In spinal hemiplegia the reflex may be unilaterally present. Cases 8, 9 and 10 illustrate these points. That it is often the only reflex obtainable besides the flexion reflex is illustrated by Cases 11, 12 and 13. The author points out that the bulbocavernosis (S3) and the biceps (L4 and S1) are not segmentally or peripherally connected; therefore it must be a synergy and related to the cutaneous reflexes with their limited brief responses rather than to the ample widely moving synergic reflexes so-called, previously described.

The writer found that by pressing downward on the clitoris in forty out of seventy women (57 per cent.) a contraction of the vulva (bulbo cavernosis) and of the sphincter and levator ani, with synergic bilateral contraction of the biceps occurred. The clitoris and penis therefore are not only homologous structurally but have the same reflex nervous mechanism.

The analogue of the bulbocavernous reflex in man is found in the spinal male frog killed during mating time. Touching the animal's chest causes a movement of embracing (Rana and Bufo). The author believes it is a coitus synergic reflex, because in animals having no glutei and who do not assume the erect posture the flexors of the leg are the muscles used in coitus for fixation, the muscles above the pelvis being used to introduce the penis and complete the act. In man the rotation of the leg on the pelvis is slight, the glutei acting more strongly to rotate the thighs on the pelvis.

6. *Clinical Significances.*—In cord lesions involving mostly the pyramidal tracts the contention of Walshe that there is a double innervation of the two systems—flexor and extensor—seems to be borne out; the extensor static system is stronger hence the patellar and ankle clonus and hyperflexion, but increase of the synergic reflexes also occurs due to flexor hypertonus. The extensor hypertonus is static and contracture occurs in extension through its dominance (decerebrate rigidity). In these purely pyramidal injuries the flexion, phasic musculature causes only mild flexion reflexes. When, however, the lesion is complete, the paraplegia should show flexor responses because the paracerebellar tonic impulses do not reach the extensor system allowing the purely spinal flexor system full play, resulting in some cases in contractures in flexion which may be permanent.

The author saw only one case of complete areflexia of all types. This occurred in a low complete lumbosacral crush (Case 14). The greatest signs of automatism of the cord were found in partial lesions, without too much trauma, infection or circulatory disturbances in the cord. The presence of synergic reflexes is a sign of grave cord injury. The author never saw a patient recover or improve much who had these signs. An apparent contradiction as to the prognostic seriousness of these signs is found in cases of Friedreich's and heredocerebellar ataxia in which sometimes the reflexogenous zone includes the whole body without the presence of the serious paralyses or contractures seen in paraplegic soldiers.

These reflex phenomena begin in the second week after injury, increase in intensity for a while then remain stationary (in one case for two years) for a long time. They disappear sometimes in complete lesions.

Babinski's flexion paraplegia is not, according to Walshe and Thomas and the author, an indication of mild pyramidal involvement, but is due to the frequent incitement of the flexion reflex, the lower extremities assuming this attitude as a result of contractures. At first, the author insists that in these patients with flexion paraplegia, another reason than the mechanical contractures is operative, for, after the initial shock was over, these patients lying in passive extension (flaccid paralysis), soon changed to active spastic flexion. The paralysis is probably originally one in flexion, the later attitude being inhibited by the shock. All of the author's patients with flexion paraplegia were seriously injured, with complete motor and sensory loss. In these cases the ankle and patellars are diminished and the biceps and other flexors give active reflex responses.

OSNATO, New York.

UEBER DIE FASERANATOMISCHEN BEZIEHUNGEN ZWISCHEN DEN KERNEN DES THALAMUS OPTICUS UND DEN FRONTALEN WINDUNGEN (FRONTAL REGION) DES MENSCHEN (ANATOMIC RELATIONS OF THE NUCLEI OF THE OPTIC THALAMUS AND THE FRONTAL REGION OF THE HUMAN BRAIN). TSUNESUKE FUKUDA, Schweiz. Arch. f. Neurol u. Psychiat. 5:325, 1919.

The investigation undertaken by Fukuda was for the purpose of determining whether the frontal lobe is provided with a more or less definite projection system or whether this is absent as maintained by Flechsig; also whether definite areas of the frontal lobe are intimately related with given portions of the thalamus. He resorted to the method of secondary degeneration as produced by old, more or less sharply demarcated lesions of the frontal cortex. Thirteen brains were studied in great detail.

The first patient, 72 years of age, who died of carcinoma of the esophagus, had attempted suicide fifteen years previously by shooting himself in the right frontal portion of the head. Investigation showed that the injury was located in the first, second and third right frontal convolutions, involving principally the posterior third, a portion of the operculum and the anterior portion of the first temporal convolution. There was a well demarcated secondary degeneration in the dorsal lenticulo-optic segment of the internal capsule. Evidence of progressive secondary degeneration of the nerve cells was noted in the nucleus lateralis, the nucleus medialis and the nucleus ventralis anterior of the thalamus.

The second case was that of a woman, 59 years of age, who presented signs of brain tumor. She was operated on, and it was ultimately proved that the condition was encephalitis with destruction of the second and a portion of the third frontal convolutions. A secondary degeneration was found in the nucleus lateralis, the anterior portion of the nucleus medialis a, and a slight diffuse degeneration in the anterior portion of the nucleus ventralis anterior.

The third brain was that of a man, 50 years of age, in whom a dementia paralytica was suspected by the mental symptoms, but who proved to have a sarcoma about 5 cm. in diameter in the anterior portion of the left frontal lobe. A portion of the first and second frontal convolutions was destroyed with secondary degeneration in the nucleus medialis a, the anterior portion of the nucleus lateralis, and the nucleus ventralis anterior.

The fourth case was that of a 5 year old microcephalic idiot. Necropsy showed a marked and rather extensive cystic condition of the brain. On the left side, only the inferior convolution of the frontal lobe, the island of Reil, the greater portion of the temporal lobe, the caudal portion of the gyrus marginalis, and the ventral half of the occipital lobe of the left hemisphere remained. On the right side, the basal portion of the frontal lobe, the caudal portion of the second and third frontal gyri, the temporal lobe, and the basal portion of the occipital lobe remained. On the left there was evidence of secondary cellular degeneration in the anterior portion of the tubercle, the lateral nucleus, the nucleus ventralis anterior, the nucleus medialis a, and the nucleus ventralis a and b. On the right, the anterior half of the anterior tubercle showed slight degeneration, the nucleus lateralis complete degeneration, and the nucleus medialis marked degeneration.

Case 5 was a 13 year old child with encephalitis involving the caudal portion of the second and third left frontal convolutions and the anterior portion of the pars opercularis of the precentral convolution. Secondary degeneration could be followed through the internal capsule into the thalamus, which disclosed a moderate degeneration in the nucleus ventralis anterior and the central portion of the nucleus lateralis; the nucleus medialis a was degenerated somewhat more markedly, while the nucleus medialis b contained only a few degenerated cells.

Case 6 was a patient 47 years of age, who had had an extensive hemorrhage of traumatic origin into the left frontal lobe, followed by the formation of a large cyst. The ventromedial portion of the first frontal, including the gyrus rectus, and a portion of the posterior medio-orbital region remained. The anterior part of the left internal capsule was markedly destroyed. There was a marked degeneration of the nucleus medialis a, particularly in the anterior portion, the nucleus medialis b, the nucleus lateralis, and the nucleus ventralis. The tuberculum anterior was reduced only a trifle in volume.

The seventh case was that of a 54 year old man who died of a glioma located in the left island and spreading into the third frontal convolution. A second, smaller glioma was noted in the extreme anterior portion of the lenticulostriate body, involving the pyramid. Secondary degeneration was noted in the anterior third of the nucleus ventralis anterior and in a small portion of the nucleus medialis a.

Case 8 had a tubercle about 2 cm. in diameter located in the posterior portion of the left first frontal convolution and the paracentral lobe. From this area degenerated fibers could be traced through the medial portion of the internal capsule to the thalamus. The anterior tubercle, the nucleus medialis a, the nucleus lateralis, and the nucleus ventralis anterior showed degeneration.

The ninth case was that of a man, 37 years of age, afflicted with endocarditis, who had had an apoplectiform insult nine months before. Necropsy showed a multilocular cyst in the second and third frontal convolutions and in the temporal lobe. Practically all of the thalamic nuclei, with exception of the tuberculum anterior, showed high grade degeneration. The latter was normal throughout.

Case 10 was that of a man, 55 years of age, who died of pulmonary embolism and who had sustained an apoplectiform insult three years before. A lesion involving the inferior two thirds of the precentral gyrus and the caudal portion of the third frontal was found. Secondary degeneration proceeded through

the internal capsule into the thalamus with degeneration in the nucleus ventralis anterior, the dorsal third of the nucleus lateralis and the nucleus medialis b.

Case 11 was that of a man, 75 years of age, who had a hemorrhagic cyst in the median portion of the second and third convolution, from which a degenerated bundle of fibers could be traced through the internal capsule to the thalamus with destruction of the nucleus lateralis, the nucleus ventralis anterior, and the nucleus medialis b.

Case 12 was that of a patient 44 years of age, who on necropsy showed a sarcoma involving the upper half of the left central convolution extending to the medial surface of the hemisphere. There was a slight degeneration of the internal capsule. The middle section of the nucleus medialis was destroyed.

Case 13, a patient 35 years of age, had a sarcoma located in the anterior portion of the first and second frontal convolution on the right side. The nucleus ventralis anterior and the nucleus lateralis were degenerated.

In his summary, Fukuda states that, according to Flechsig, the massive bundle in the anterior portion of the internal capsule proceeds to the frontal lobe. The latter assumed, however, that these fibers change their course in the region of the knee of the internal capsule and, making an arch, break through the pyramidal tract and ascend to reach the anterior portion of the sensory area. He looked on the frontal lobe and these tracts as being a large association center which furnishes the anatomic basis of intellect.

Fukuda constantly found evidence of secondary degeneration proceeding from the corresponding fibers of the internal capsule to the lateral and anteroventral portions of the thalamus. The relations of the anterior tubercle and nucleus medialis are not so constant.

While it was established that in larger defects of the frontal lobe, the anterior portions of the thalamus, particularly the nucleus lateralis, undergo degeneration, the more exact location of lesions in the frontal lobe, which bring about degeneration in so many portions of the thalamus, becomes more difficult. This is particularly true of this series in which the location, the extent, the age of the patient, the duration of the lesion and the nature of the pathologic processes were so variable. In five cases tumors were present, in one each porencephaly and embolism of the Sylvian artery, in two the lesions were traumatic, in four encephalitic. On the whole, therefore, the lesions in the author's cases showed little tendency to be sharply demarcated.

His conclusions relative to this relationship are: The posterior portion of the second frontal convolution and the nucleus medialis a, following von Monakow's division of the median portion of the thalamus, are intimately related.

The cortical representation of nucleus medialis b is the posterior portion of the third frontal convolution.

The cortical representation of the nucleus lateralis is not sharply demarcated, but seems to be widely distributed over the frontal lobe.

Degeneration of the tuberculum anterius is, so far as the frontal lobe is concerned, only a relative affair. In no single case was the entire nucleus degenerated. The author feels, therefore, that the tuberculum anterius assumes a peculiar relationship, which may in part be explained by its participation in the relation with the corpus mamillare through the bundle of Vicq d'Azyr.

The nucleus ventralis anterior and the nucleus dorsolateralis show the same

general changes in frontal lobe lesions in that the small nerve cells, particularly in large lesions of the frontal lobe, are almost totally destroyed. The cortical representation of these two nuclei must be an extensive one.

In general it may be said that the median portions of the thalamus are less degenerated than the lateral, the degeneration becoming less the nearer the ventricle is approached. The author infers that the thalamocortical projection fibers from median portions of the thalamus become progressively more divergent, as opposed to those arising from the lateral portions; the median portion does not degenerate nearly so much as the lateral and only in part when the posterior portions of the second and third frontal convolutions are involved. His observations do not confirm those of Nissl, who by experimentally removing the subcortical white matter found degeneration of all nerve cells in the right thalamus as far as the commissura mollis, that is, inclusive of the central gray matter. This does not occur in man. On the contrary, Fukuda found that, even in extensive lesions, the gray matter about the third ventricle, the tuber cinerium and the majority of fibers in the tuberculum anterius, remained practically intact. In serial sections of a cat's brain from which von Monakow had removed the entire cortex, he found a complete degeneration of these cells in only one instance, which he infers was not the result of secondary degeneration, but was due to a primary encephalomalasic necrosis. The cells, almost exclusively preserved, are small ones, and particularly those near the lumen of the third ventricle; these are not related to the fibers of the capsule which run to the frontal lobe. Experimental work of von Monakow shows that the chief cells of the thalamus are related to the cortex, while the smaller ones stand in intimate relation to the retrothalamic fibers coming from the tegmentum.

WOLTMAN, Rochester, Minn.

SUR UN CAS D'ACROMEGALO-GIGANTISM AVEC PHYCHOSE MANIAQUE DEPRESSIVE (A CASE OF ACROMEGALIC GIGANTISM WITH MANIC DEPRESSIVE PSYCHOSIS). PARHON and STOCKER, Rev. neurol. **35**:573 (July) 1919.

The authors refer briefly to the work of eminent writers whose results in studies of the thyroid, pituitary and thymus glands establish beyond question the influences of these glands on growth and development of the human organism. He then quotes Henri Meigs (Li gigantisme, 1912) who inquires whether one may not assert that the enfeeblement of the genital function plays the most important part in the occurrence of skeletal anomalies.

Not only do physical anomalies show themselves as the result of disturbances of the internal secretions, but there is a close relationship between psychic disorders and disorders of the endocrine system.

The authors refer briefly to the Abderhalden reaction, especially in dementia praecox and in manic depressive cases, and then list under eight heads phenomena common to Basedow's disease and the circular type of manic depressive insanity to show how close is the relationship between them:

1. Clinical symptoms of thyroid disturbances in manic-depressive cases, such as exophthalmia, goiter, tachycardia, etc.

2. Resemblance in the mental state of those suffering from manic-depressive insanity and from Basedow's disease.

3. Basedow's disease, and an affective psychosis in the same patient.

4. The average or medium weight of the thyroid body in the manic-depressive patient is equal to the maximal or upper limit of that in normal persons.

5. The frequency of the two disorders in the female sex.

6. The coincidence of the two diseases at periods in which hyperthyroidism is common, such as at puberty and the menopause.

7. Hyperexcitability of the vegetative nervous system in both disorders.

8. The therapeutic effect of thyroidectomy.

According to Brunet (*These de Paris,* 1899), mental troubles are eight times as frequent among acromegalic people as among normal persons. Reports of many cases of acromegaly with frank psychoses have been published. In the majority of cases it is the manic, or the depressive phase of manic-depressive insanity.

The authors cite authorities who have reported one form or another of thyroid disturbance occurring in cases of acromegaly, and other authorities who have tried to show that in cases of gigantism elementary psychic disturbances are the rule, such as infantile or puerile reactions, effeminate traits, lack of energy, lack of will, etc.

The weight of the thyroid in giants is usually greatly increased; cases in which the weight was as high as 75 and 112 gm. have been reported.

The true psychoses are not frequently found among acromegalic patients. Cromwell's porter, Daniel, had a mania for prophecy. Parhon (1910) describes a case of gigantism with periodic psychosis and Gelma (1912) reported a case of Basedow's disease combined with gigantism and a periodic psychosis.

The authors report in detail their own case of acromegalogigantism complicated with a periodic psychosis. The more interesting features in the case are:

1. The patient was a man, 30 years of age, single, a bank clerk.

2. He was first seen at the clinic for nervous diseases at Jassy, in May, 1916. He was transferred to the hospital for the insane at Socola in June of the same year, and discharged the following September. He was readmitted on March 28, 1918, in manic excitement, having delusions of persecution.

3. Family History: His father was tall, high strung, impulsive, not alcoholic or syphilitic. His mother died of pulmonary tuberculosis. He had two sisters—the older normal, the younger a congenital deaf mute.

4. Makeup: He was quiet and amiable as a child; he became malicious and ill-tempered; later he was again even tempered and congenital. Alcoholism and syphilis were denied up to the age of 10. At that age his growth was about normal; from then on, growth was unusually rapid. At 12 he had the appearance of a youth of 15.

5. Physical Examination: The patient was 6 feet tall and thin. At the age of 16 or 17 he was obese. His head was small compared with his height. The frontal sinuses were prominent, giving the appearance of enophthalmos. The iris of the right eye was gray; of the left, brown. His tongue was thick (6 cm. wide). There was striking prognathism of both maxillae; the malars were prominent. The ears were flaring but without other stigmas. His face in general was symmetrical, but developed out of proportion to the rest of the head. The thyroid gland was negative clinically.

The larynx and the pelvis were feminine in type The genital organs were small, but not otherwise abnormal. Sensibility and motility were negative.

6. Mental examination revealed an anxious appearance, wringing of the hands, a depressed and sad mood and frequent deep sighs. The voice was deep and whining. His gaze was fixed, and he was indifferent to his surroundings.

He was introspective; his speech was confused; and at times he acted as if recalled from another world. Replies to questions were labored and retarded.

He had delusions of unworthiness, including ideas of being sacriligious, of practicing onanism and adultery.

(Testicular extract seems to have had some beneficial effect.)

During his second commitment he was quiet and respectful, but mingled with other patients, and engaged in spontaneous conversation.

His attitude was that of extreme submission. When the physician made his rounds the patient would fall to his knees, and embrace the physician's hands and feet. He asked for prayers of others. He refused food and drink. He had grandiose ideas about his parents whom he spoke of as though deified. At the death of his mother all hope left him.

He frequently wrote letters of supplication to the director of the hospital and in them reiterated his ideas of self-depreciation. Opposed to such ideas. he frequently exaggerated his own abilities as a child and student. He wished to complete his studies that he might bounteously bestow beauty and good on the world. For this reason he begged to be released, that he might go on with his doctorate. At times he expressed some insight into his mental illness, and expressed philosophical ideas about the work of such poets as Goethe and Shakespeare and quoted Schopenhauer. Then he would drop back into his former state, promising to become a "normal man" if set at liberty. He spoke of his life of chastity, and for this reason was determined to marry a princess; but he was sure that a queen had had relations with him; that was why he was being persecuted.

On the following day he would deny all these fantasies. Two months after admission the patient was discharged almost recovered.

Authors' Conclusions.—1. The authors do not believe that the case presents simply a coincidence of mental disorders and acromegalogigantism.

2. They regard the case as illustrating the dependence of psychic phenomena on physical disorder.

3. The influence of the internal secretions is as great in gigantism as it is in acromegaly.

4. One internal gland cannot be altered in function without a disfunction of the other internal glands.

5. Manic-depressive insanity may in certain cases be due to thyroid disfunction.

6. The authors' case shows how disorder of thyroid activity upsets the equilibrium of the other internal glands in an acromegalic giant and that the psychic manifestations of the manic-depressive type are apparently due to a functional disorder of the thyroid glands.

JONES, Detroit.

APHASIE ET APRAXIE (APHASIA AND APRAXIA). LAIGNEL-LAVASTINE, Bull. méd. Par. **34**:277 (March 20) 1920.

The published report of a clinic by the writer gives with considerable conciseness his opinions regarding aphasia and apraxia.

For the former he studies spontaneous speech, the speech of repetition, reading aloud, spontaneous writing, writing from copy, writing from dictation, comprehension of spoken and written words, and divides the aphasia into two groups according to whether there is any trouble of interior language. If there is, one speaks of intrinsic aphasia and if there is not, of extrinsic aphasia.

The best known test for this is that of Proust-Wernicke-Lichtheim-Déjerine. The patient is shown an object and asked to open and close the hand as often as there are syllables in the word. In intrinsic aphasia the patient does not know the number of syllables. This permits the separation of pure motor aphasias from the aphasias of Broca in which motor aphasia is united with troubles of internal language. The extrinsic aphasias are divided sometimes into four groups: (1) pure motor aphasias, (2) pure alexia, (3) agraphia, and (4) pure word deafness. Déjerine doubts the existence of a pure agraphia and P. Marie questions the occurrence of pure word deafness.

The intrinsic aphasias are divided into two groups: (1) the aphasias of Broca, characterized by the loss of ability to articulate, and (2) the aphasia of Wernicke characterized by the loss of comprehension. The aphasias of Broca have usually sensory-motor association, such as hemianopsis, hemiplegia and hemianesthesia, which are absent in general in the aphasias of Wernicke.

In addition to the sensory-motor association, in the aphasias one finds agnoso-aphraxic association.

Considering the sensory inflow and motor outlet and normal transmittory interior connection, there are three apraxias: (1) the ideational apraxia or apraxia of conception, (2) ideomotor apraxia or apraxia of transmission, and (3) motor apraxia, strictly speaking, or apraxia of execution.

To analyze these apraxic disturbances one employs tests of movements of the following type: simple, reflex, expressive, descriptive and transitive (the latter involving the handling of several objects). It often happens that apraxia (in a right-handed person) is greater in the right arm. This is accounted for by a residual slight hemiplegia causing a right motorapraxia in combination with a bilateral ideomotor apraxia. The patient with ideomotor apraxia recognizes objects, their name and their use. This eliminates ideatory apraxia. He understands the end in view but cannot imagine the kinetic processes which would permit him to arrive at it.

It is necessary to distinguish between apraxia and ataxia. The ataxic patient directs himself hesitatingly toward an end and his conception of the end is correct. When he proceeds slowly he completes the action, and when he modifies his action, it is to improve it. The apraxic patient does not improve by repetition. When he tires he becomes more and more maladroit and never attains his purpose.

The localization of the lesion in ideomotor apraxia is established. It is the result (in right handed persons) of a lesion located in the left parietal lobe, more especially in the left supramarginal gyrus. A lesion of the left cerebrum determines a bilateral apraxia, which predominates on the right. When (in a right-handed person) the apraxia predominates or exists alone on the left, there is also either a lesion of the corpus callosum or an associated lesion of the right cerebrum.

As regards the relation between aphasia and apraxia, aphasia is a particular case of apraxia. Ideatory apraxia corresponds to dyslogia, motor aphasia to anarthria and ideomotor apraxia to aphasia.

Visual agnosia corresponds to word blindness and auditory agnosia to word deafness. There is further a parallelism between jargonaphasia and paraphasia and the parapraxia which is the result of agnosia. Motor aphasias are only a species of apraxias.

DAVIS, New York.

TRAITEMENT DE CERTAINES FORMES DU VERTIGES DE MENIERE PAR LA TREPANATION DECOMPRESSIVE (TREATMENT OF CERTAIN FORMS OF MENIERE'S VERTIGO BY DECOMPRESSIVE OPERATION). HENRI EBOULKER, Rev. neurol. **26**:493 (June) 1919.

Since the pathologic conditions of the labyrinth have become better known, the term "Ménière's vertigo" has been abandoned by modern otology. Nevertheless, the author uses it in this discussion because it has remained in current usage in general practice and serves to designate nonsuppurating labyrinthine conditions without specifying their pathogeny.

Ménière's vertigo is a syndrome characterized by deafness, tinnitus, vertigo and vomiting. Labyrinthine conditions secondary to suppurative processes of the middle ear present the same symptomatology. They reach the posterior-inferior region of the skull through large lymphatic and vascular communications. They end either in the formation of suppurating foci or in different meningeal conditions. Besides these suppurating conditions, the author believes there are nonsuppurating processes in which inflammation misses the labyrinthine apparatus and produces a certain degree of hypertension of the posterior-inferior region which calls for decompressive measures. He reaches this conclusion through analysis of symptoms and therapeutic evidence.

This syndrome, outside of the purely labyrinthine symptoms—vertigo, tinnitus, deafness and vomiting—presents headache with occipital localization. The patients localize the headache perfectly at the back of the head, on the same side as the tinnitus and deafness. In cases of vertigo, besides headache, one may also localize a sore spot on pressure, at the posterior portion of the mastoid. Before examination, the patients complain of these pains and give the impression that they have an inflammatory complication of suppurative otitis. "I must have an abscess." This is the way in which they describe their sensations.

Intracranial hypertension, which the author believes real in certain cases of vertigo, reacts on the labyrinthitis which then appears like a true "labyrinthitis of stasis" in the syndrome of compression of the cranial cavity.

Babinski, long ago, showed the usefulness of lumbar puncture in the treatment of vertigo. All patients with vertigo do not improve under this treatment, but some improve immediately. The patient feels as if he were born again; the tinnitus and the vertigo decrease or disappear, the vomiting ceases. Often the symptoms reappear soon but again disappear at the next puncture.

How can this sudden improvement be explained if it is not through a quick decompression of the posterior-inferior region of the meningeal cavity, reacting on the intrapetrous and extrapetrous labyrinthine passages? The resemblance is better seen in the evolution of the symptoms of patients who are not benefited, or slightly benefited by these punctures, and who apparently are cured by decompressive trepanation.

It is customary to judge the degree of hypertension by the pressure of the cerebrospinal fluid; but in cases of vertigo, it is not rare for the fluid to flow drop by drop. However, that does not prevent the patient from improving for a time after each puncture. Sicaid and Pullain have shown "that there does not exist any exact accordance between the hypertension of the cerebrospinal fluid, verifiable by puncture, and the hypertension of the intracranial cerebrospinal fluid." In several cases of cerebral tumor, confirmed by necropsy, it has been noted that, in spite of clear signs of cerebral hypertension—violent headache, vomiting, papillary stasis—the hypertension has not been discover-

able by lumbar puncture. The cerebrospinal fluid at different punctures flows out slowly—at times, drop by drop. M. Claude says "We cannot gain information on the intraspinal pressure by the one proof of the way in which the cerebrospinal fluid flows through the needle; we must have a manometric measurement. Great pressure is observed even when the liquid flows drop by drop." The author has personally observed some significant cases in which there was absence of papillary stasis and a flow of cerebral fluid drop by drop coexistent with an enormous intracranial pressure. He cites cases that have come under his observation. Claude's manometric puncture should be applied particularly to the study of these arrested hypertensions, which it can help to bring into evidence.

Dry labyrinthitis corresponds frequently, from the anatomic-pathologic point of view, to arteriosclerosis of the labyrinth, as Escot has demonstrated, and to general arteriosclerosis of the arterial system. Labyrinthine hypertensions are often arterial hypertensions. Patients afflicted with arterial hypertension exhibit signs which are connected with increase of the cerebrospinal fluid and which can simulate in all respects the picture of a cerebral tumor.

Sometimes alterations of the fundus, which are really papillary stasis, can produce the change, but arterial manifestations account for the increase of pressure of the cerebrospinal fluid as lumbar puncture quiets them in a remarkable way.

In cases of arterial hypertension with intense headache, M. Vaquez advises the systematic use of bleeding in addition to lumbar puncture. He has drawn as much as 60 c.c. of fluid and has never had an accident. The headache and nervous trouble have been considerably lessened.

The author states that he has accepted from the work of M. Castaigne his opinions on arterial hypertension and intracranial hypertension. They appear to him to throw light on the pathogeny and treatment of the forms of Ménière's vertigo, connected with circulatory and cerebral manifestations and considered in all cases as purely local conditions. This symptomatic triad—arterial hypertension, labyrinthine hypertension and cerebral hypertension—constitutes the links in one chain. As the local lesion has its point of departure in the internal ear, whose vascular and lymphatic passages end in the postero-inferior region of the cranium, it is natural that the cerebral manifestations should exist principally in the cerebellar cavity and that, by preference, decompression should affect the same region.

In all serious labyrinthine conditions, it is important to search for the most frequent causal affections. There should be examination of the urine for albuminuria and diabetes and an examination of the blood for syphilis. These causal affections eliminated, we should look for arterial hypertension and pressure of the cerebrospinal fluid. Hypertensive medication, bleeding and lumbar puncture should be used methodically. If these are unsuccessful, we are justified in considering decompressive trepanation.

The author advocates, in certain cases, craniectomy under a local anesthetic. He has frequently performed under local anesthesia all forms of surgery of the skull, brain, face and neck. He refers to an article by himself in which he has enumerated eleven craniectomies of the temporal, parietal and occipital regions. He gives in detail the technic of his procedure. He cites the cases of two women troubled with a serious form of Ménière's vertigo. Vertigo, vomiting and tinnitus made existence intolerable. All the usual medications had been tried without result. One of the patients, the first one operated on, said that she would make an attempt on her life if the author

did not succeed in helping her. He resorted to decompressive trepanation and the patient was cured. The second one was also operated on and cured. He reported these cases in February, 1913, giving details of these and at least two other cases with similar results.

JONES, Detroit.

BRACHIAL BIRTH PALSY, A PSEUDOPARALYSIS OF SHOULDER JOINT ORIGIN. T. TURNER THOMAS, Am. J. M. Sc. **154**:207 (Feb.) 1920. Author's Abstract.

From a considerable experience with traumatic brachial paralysis, including eighteen cases in adults with flail shoulder joint and forty-four cases of obstetrical paralysis, it is concluded that in most cases the paralysis is not permanent but slowly disappears completely. In a small number of adult cases the shoulder joint becomes flail and these patients develop a permanent paralysis with atrophy of the shoulder muscles of varying severity, the rest of the limb showing much improvement but never becoming normal. In all of the cases of obstetrical or brachial birth paralysis, in which there was serious crippling of the limb with muscle atrophy, as late as 5 or 6 years of age, there was found a posterior subluxation of the shoulder joint. Those without any abnormality of the shoulder joint at that age had recovered full power and function of the limb. From this kind of evidence it is argued that the basic causal lesion is in the shoulder joint and not in the brachial plexus. The paralysis is real in the early stages but is termed a pseudoparalysis here in the sense that it is only temporary and is probably not due to a serious nerve injury but to inclusion of the branches of the plexus in the axillary inflammation resulting from the joint injury.

There have been no case reports of obstetrical paralysis in adults because by that age the paralysis has disappeared, only a varying crippling of the limb from some residual shoulder joint distortion remaining in the most severe cases. The adult case on which Madame Klumpke based her study was one of total permanent, flaccid paralysis of motion and sensation, and did not belong to this group of cases.

Postmortem and operative findings recorded in the literature showed that the nerves were involved in a cicatricial tissue formation, probably resulting from their proximity to the articular and peri-articular tissues damaged at the time of the original injury. The reported nerve ruptures found at operation may be ascribed to a faulty interpretation of these cicatricial tissue changes. If not operated on, the paralysis ultimately disappears.

It has long been recognized that these birth cases have a pathology similar to that of many adult cases following injury to the shoulder region. The pathology of the adult cases has never been established and up to the present time is being variously interpreted. Erb established his theory of a rupture at the junction of the fifth and sixth cervical roots of the brachial plexus on his four adult cases. His single obstetrical case was incidental. Yet his theory has lived only in connection with the obstetrical cases. In connection with adult cases it has long been obsolete.

The Duchenne-Erb theory of a rupture of the brachial plexus so localized as to produce a paralysis of the same four or five brachial muscles every time has been widely accepted but not corroborated. The only exact scientific evidence on which this theory is resting is the finding of this exactly localized paralysis by electrical examination in four cases of obstetrical paralysis by Duchenne and in one by Erb, and in Erb's four adult cases.

The support of this theory obtained by experimental work on infant cadavers is open to some question. Most, if not all, experimenters have admitted that "great force must be employed to produce the lesion." The author tried direct extension on the head and lateral bending of the neck on both sides of the neck in six infant cadavers, with probably much more force than any competent physician has ever employed in a successful delivery, without obtaining the slightest evidence of a rupture of the brachial plexus.

THOMAS, Philadelphia.

KYSTE CONGENITAL INTRASPINAL PROBABLEMENT MENINGOCELE ANTERIEURE FERMEE (CONGENITAL INTRASPINAL CYST PROBABLY A MENINGOCELE CLOSED ANTERIORLY). KNUD H. KRABBE, Rev. neurol. **26**:561 (July) 1919.

The author reports a case of congenital cyst of the spinal cord with symptoms appearing shortly after birth. The principal points in the case are: Fundus, normal; fontanel, normal; neck, short; kyphosis at the dorsal curvature; abdomen, large and flabby, showing paralysis of the abdominal muscles; lower extremities and trunk analgesic up to nipple line. Above this line there was normal reaction to pin prick. Roentgen-ray examination of the spinal column was negative. There was paraplegia but no atrophy. One month after birth there were hypertonia and contracture of the lower extremities. There were no fibrillary twitchings. The muscles of the face and upper extremities showed normal reactions to galvanic and faradic currents. Function of the sphincters was normal, but the bladder was occasionally distended. There was no decubitus and no vasomotor disturbance. The spinal fluid on two occasions was tinged with blood and later feebly tinted yellow. Culture of the fluid was negative. Intellectual, or rather mental, reactions were apparently normal. There were progressive but gradual weakness, loss of weight, cyanosis, and finally death. Laboratory examinations were negative, except for a slight eosinophilia.

Necropsy examination revealed bilateral bronchial pneumonia; abdominal organs negative; brain, microscopically negative. At about the fifth dorsal segment, in the leptomeninges, anteriorly, there was a cyst 2 cm. long, 6 mm. broad and 4 mm. thick. This cyst exerted pressure on the cord which, in section at the level of the cyst, took the shape of a crescent moon. Below the cyst there were adhesions between the leptomeninges and the dura mater. Microscopic examination showed no evidence of tumor or hemorrhage. In the cervical and upper dorsal regions of the cord there was marked degeneration in the columns of Goll, more marked toward the external portion of the cord. There was an increase of neuroglia in the degenerated areas. The myelin sheaths in the lateral cerebellar columns and in the tract of Gowers was well preserved, as well as in the anterior columns; elsewhere, they were in great part destroyed. Much of the gray matter and of the posterior columns showed neuroglia proliferation. The central canal was flattened but open. Below the cyst there was a noticeable degeneration of the pyramidal tracts with increase of neuroglia; this was also true of the anterior columns, and of the anterior horns. The sacral spinal cord showed a number of small defects completely filled with compact connective tissue and the motor cells of the anterior horns completely destroyed.

The author's conclusion is that the case presents a cystic formation, congenital, in the sense that the symptoms appeared so rapidly after birth. He rules out hemorrhage and necrotic tumor. He states that he has not succeeded in finding in the literature any description of a congenital cyst in the anterior portion of the cord. He grants that it might be considered a variety of meningocele. Surgical intervention might have resulted in improvement, but laminectomy in so young a child would have been dangerous. Difficulties in diagnosis lie between hematomyelia, cyst and hematomyelia combined with tumor. The history led the author to diagnose the condition as hematomyelia. What necropsy examination showed has already been described, and constitutes the reason for reporting the case.

JONES, Detroit.

PARAPLEGIA AFTER ARSPHENAMIN. T. J. DIMITRY, J. A. M. A. **74**:1150 (April 24) 1920.

Dimitry reports the case of a man who suffered a complete loss of sight before other symptoms developed to make possible a diagnosis, though some precursory symptoms obtained in his history were not recognized at the time as being important. Fundus examination elicited a distinct elevation of the optic nerve of both eyes. This elevation was greater in the right eye. The pupils were widely dilated and did not respond to light. Tests for syphilis were negative. Following the intravenous injection of 0.06 gm. of arsphenamin, the patient complained of stiffness in the legs and pain in the back. He could not move his right leg, and during the afternoon this paralysis extended to the other leg. It was necessary to catheterize the bladder and later to contend with an overflow of the urine. He suffered an inability to evacuate the bowels and subsequently an incontinence of feces. He developed decubitis and a painful hyperesthetic area of the left arm. The paralysis of the legs was absolute, and all voluntary motion and sensation in all its qualities, including temperature and touch, was destroyed. Different degrees of deep and superficial anesthesia and hyperesthesia extended to within an inch of the nipple anteriorly and not quite so high posteriorly. The reflexes were abolished in the legs with a flaccid paralysis and the appearance of a rapid wasting. Two days after the injection of arsphenamin, the elevation in the optic nerve had improved and within the next day had disappeared entirely, leaving a normal appearing optic nerve, though the patient was blind. In spite of the apparently harmful effect of the arsphenamin, a second dose of 0.06 gm. was given and a dose of 0.09 gm. of neo-arsphenamin was given a few days later. Mercury was given by inunction and the iodids were used in increasing doses. For weeks the patient took 75 drops of saturated solution of potassium iodid three times a day. Seven months later the patient could walk and had practically perfect vision. There remained some bladder disturbance. The Wassermann reaction with 0.75 c.c. of spinal fluid was negative. The cell count was 173; of these cells, 95 per cent. were lymphocytes. The colloidal gold curve was similar to the curve found in tuberculosis. The blood Wassermann reaction was negative.

The author is of the opinion that arsphenamin played no part in the development of the myelitis. He regarded the case as one of retro-bulbar optic neuritis with myelitis, which is a definite clinical entity. A brief review of the literature of this condition is made and also a review of cases of paralysis following the use of arsphenamin.

KLAUDER, Philadelphia.

RECHERCHES EXPERIMENTALES SUR LE VIRUS DE L'ENCEPHALITE LETHARGIQUE (EXPERIMENTAL RESEARCH REGARDING THE VIRUS OF EPIDEMIC ENCEPHALITIS). C. Levaditi and P. Harvier, Bull. de l'Acad. de méd. **83**:365 (April 20) 1920.

In February, 1920, these workers succeeded for the first time in inoculating a rabbit with virus from a patient with epidemic encephalitis. The material used consisted of an emulsion of the cerebral gray substance (cortical, mesencephalitic and bulbar) obtained at necropsy from a woman of 46 who had died of encephalitis on the ninth day. In this patient there had been fever, facial herpes, light somnolence, aphasia, carphologic movements, urinary retention and slight lymphocytosis of the spinal fluid. (Necropsy confirmed the clinical diagnosis and showed inflammatory and perivascular alterations located chiefly in the bulb and Broca's convolution.)

Two tenths of a cubic centimeter of the emulsion was inoculated into the brains of each of two rabbits and a monkey. One of the rabbits died on the eighth day. Cultures of the brain and blood remained sterile. Histologic examination showed characteristic meningeal encephalitis lesions of the cortex and mesencephalon. The other two animals survived without symptoms.

An emulsion of the nerve centers of the rabbit which had succumbed, was inoculated, in the dosage first used, into the brains of two rabbits. These died on the sixth and seventh day, showing the identical lesions.

The following findings and conclusions are summarized:

1. The period of incubation of the sickness after intracerebral inoculation is four or five days. In animals, the morbid symptoms, torpor and epileptic, myoclonic or choreic movements, appear only a few days before death.
2. The virus survives in glycerin.
3. The virus is filtrable (Chamberland 1 and 3).
4. In the rabbit, the virus is inoculable by way of the peripheral nerve (sciatic) and by way of the anterior chamber of the eye.
5. The virus does not appear pathogenic for the monkey when obtained directly from man but becomes so after it has been subjected to a certain number of passages through rabbits.
6. After these passages, the virus becomes pathogenic for the guinea-pig.
7. The virus preserves virulence after desiccation.
8. The virus exists in the spinal cord of animals inoculated by the cerebral route.
9. The serum of patients recently convalescent (for a month) from epidemic encephalitis possesses no neutralizing action on the virus.

Davis, New York.

NEVRITE HYPERTROPHIQUE PROGRESSIVE NON-FAMILIAL DE L'ADULTE (NONFAMILIAL PROGRESSIVE HYPERTROPHIC NEURITIS OF ADULTS). G. Roussy and Lucien Cornil, Ann. de méd. **4**:296, 1919.

These authors report a case which differs in certain respects from the two known types of the disease. The first type, that of Déjerine and Sottas, is characterized by general muscular atrophy with fibrillary twitching, hypertrophy of nerve trunks, shooting pains, ataxia, Romberg's sign, nystagmus, myosis and Argyll Robertson pupils. The pathologic basis for this is a hypertrophic interstitial neuritis. The second type, that of Marie and Boveri, is

characterized by muscular atrophy, more marked in the lower extremities than in the upper, kyphoscoliosis, exophthalmos, intention tremor and jerky speech recalling that of multiple sclerosis. The pathologic basis is an involvement of both nerve fibers and interstitial tissue.

A summary of the case follows: The onset was at 40 years of age. The man had no relations similarly afflicted. There was atrophy of the Aran-Duchenne type in the upper extremities with fibrillary twitching and reaction of regeneration. Ataxia was present in all extremities. Reflexes: Plantar and Achilles' reflexes were absent; the right knee jerk was diminished, the left, absent. The pupils were normal. Pathology: (1) degeneration of the myelin sheaths with onion shaped enlargement at intervals; (2) increase of the number of the nuclei of the sheaths of Schwann; (3) alterations of the axis-cylinders; (4) presence of many young regenerating axis-cylinders; (5) mild hyperplasia of the interstitial tissue; little or no vascular change.

Compared to the Déjerine-Sottas type, this case showed no generalized muscular atrophy, no myosis and no Argyll Robertson pupils or nystagmus, while intention tremors were present. It began later in life.

Compared to the Marie-Boveri, type there was no familial history, no scanning speech or exophthalmos, while an Aran-Duchenne type of atrophy was present.

The authors suggest the title of this paper as a name for this disease.

KRAUS, New York.

SUR LES TROUBLES DE LA CORRELATION CARDIO-RESPIRATIORE DANS LA NEUROPATHOLOGIE (DISORDERS OF CARDIO-RESPIRATORY CORRELATION IN NEUROPATHOLOGY). J. PARHON, L'Encephale **15**:185 (March 10) 1920.

One knows that the normal functioning of respiration determines, during inspiration, the virtual formation of an intrathoracic vacuum and that in this manner the emptying of the blood from the head and general venous system is facilitated. Each time that the inspirations are not sufficiently complete, in addition to a sensation of oppression or need of air, a passive venous congestion of the head and brain results, with augmentation of intracranial tension. The writer expresses his belief that this congestion and augmentation of intracranial tension seems to contribute to the explanation of certain pathologic phenomena of the nervous system. Among those phenomena are the well-known psychic troubles which one sees in cardiac cases and also such special phenomena as fascicular tremors, neurasthenic feelings of fulness in the head and certain other abnormal sensations. He points out that neurasthenics, in general, often present an insufficiency in amplitude of the respiratory movements. He has seen fascicular tremors, approaching clonic convulsions, lasting several minutes and localized in a single muscle. Abnormal sensations, especially sensations of localized engorgements, are considered phenomena in the domain of sensibility of the same order as the fascicular tremors in the domain of motility. Is there an excitation of cortical centers by the congestion—perhaps even microscopic hemorrhages—and also an acidification of the blood?

A disorder in the cardiorespiratory correlation also appears to exist in migraine. In one case, as the respirations became ample and regular, the headache diminished and then disappeared.

The sign of Bryson (the diminution of the amplitude of respiratory movements) in Basedowians is accompanied by anxiety, and this accords with the writer's conception. He says, "I have, for a long time, held that modifications of respiration have an important part in the mechanism of affective phenomena."

DAVIS, New York.

LA FORME DE L'IRREGULARITE PUPILLAIRE SYPHILITIQUE (THE FORM OF THE IRREGULAR SYPHILITIC PUPIL). E. RASQUIN, Ann. d'Oculistique **157**:162, 1920.

The conclusions drawn are based on 824 cases of irregular pupils of clearly demonstrable syphilitic origin. Particular attention was paid to the form of the irregularity, eliminating of course cases due to synechia even in the presence of syphilis.

In 107 cases the form described by Brown-Séquard and Terson as being an early and characteristic symptom of tabes was found. This consisted most frequently in the elliptical or oblong type. It is recognizable in daylight as well as in the dark room and usually is present in both eyes.

In his experience this irregularity is not a morbid entity, except when pushed to an advanced degree; in fact, normal pupils are not always perfectly round, but may be slightly oblong usually in the vertical direction.

When the irregularity is pronounced there is usually an alteration in the light reflex.

Seventy-nine per cent. of cases examined showed a form with large curved angles. At times the deformity extended almost completely around the pupillary circle, giving the appearance of a polygon with curved sides. This type exists in all forms of syphilis, even before any other pupillary symptom. It is usually bilateral, but may be unilateral.

Then there are the undefined types, such as notches and sharp angles. As a rule, these forms accompany anisocoria and alteration of the pupillary reflex, in which the syphilitic process is far advanced.

Importance is attributed to the irregular pupils because: (1) It is a condition present in all stages of syphilis; 2. It is present in 79 per cent. of cases of true syphilis. 3. It represents the minimum amount of waste in the search of irregular pupils of syphilitic origin. The author personally considers this form of irregularity, especially when bilateral, as a quasi certain symptom of syphilis. Two cases, from among many observed, are reported to substantiate his belief.

SCARLETT, Philadelphia.

LA RESTAURATION FONCTIONNELLE DANS LES COMMOTIONS MEDULLAIRES (FUNCTIONAL RESTORATION IN SPINAL CONCUSSIONS). ANDRÉ BARBÉ, Bull. méd. **34**:373 (April 21) 1920.

The author was permitted to follow step by step the functional restoration in a case showing spinal concussion.

In the middle of June, 1918, S. was wounded in the middle lumbar region by a bullet. At operation this was found at the level of the inferior border of the eleventh dorsal vertebra, having fractured the twelfth. That the cord was not actually attained was shown by the fact that it was possible to extract the bullet without at any time opening the spinal canal. No spinal fluid escaped.

The immediate symptoms from the injury included paraplegia, abolition of knee and plantar reflexes, sensory losses over the lower extremities and reten-

tion of urine and feces. Seventeen days after the wound was received the retention was succeeded by incontinence. The sensory loss comprised absolute anesthesia over the legs up to the region of Poupart's ligament. Sixty-five days following the receipt of the injury the patient could make some flexion movements of the thigh on the pelvis; the sensory condition was the same; both knee reflexes were absent; the left ankle reflex was weak, the right normally active. There was no clonus but the Babinski sign was positive on each side. Five months and a half after the injury all movements of the thighs had returned. The sensibility was then characterized by a hypesthesia of the lower half of each leg, accompanied by a thermo-anesthesia in the same area, and by loss of deep sensation. Both the knee and ankle reflexes were absent. The Babinski reflex was positive on the right and negative on the left. The sphincteric disturbance had disappeared. Seven months after his wound, the patient could walk with two canes and while lying down he could execute all movements in both feet. The improvement in the extensors was clear. Deep and superficial sensibility had returned. The knee reflex was now obtained on the right. The Babinski reflex was positive only on the right. Atrophy was greater on the left.

The writer points out the parallelism between the motor and sensory recovery. In each, the return of function progressed from the proximal portion of the leg to the peripheral. Further, superficial sensation improved more promptly than the deep.

DAVIS, New York.

RECHERCHES SUR LA PATHOGENIE DE LA CRISE DE MIGRAINE (INVESTIGATIONS INTO THE PATHOGENESIS OF THE ATTACKS IN MIGRAINE). P. PAGNIEZ and A. NAST, Presse méd. **28**:253 (April 28) 1920.

Anaphylactic phenomena in epilepsy have been previously reported by Pagniez (*Presse méd.* **27**:693 [Nov. 19] 1919, abstracted in the ARCHIVES **3**: 328 [March] 1920), and a case of migraine is discussed in connection with similar findings. The subject of the experiments had had typical attacks of migraine for years, and had found that the ingestion of chocolate, especially with milk, would precipitate an attack, but that a small dose (0.5 gm.) of peptone taken before each meal would prevent attacks even though chocolate were eaten.

The experiments consisted in giving chocolate and milk, with or without other foods, before and after discontinuing the preventive medication. Differential leukocytic counts were made after meals to demonstrate any anaphylactic evidence ("crise hémoclasique initiale" of Widal) in the blood picture. Normal digestive leukocytosis and no migraine were found following meals that included milk and chocolate, both when the preventive medication was being administered, and for several days after its withdrawal. Nine days after, however, the experiment showed instead a leukopenia (to 3,700), followed several hours later by typically severe migrainous symptoms.

The results illustrate a temporary actual immunity sometimes conferred by a drug, the existence of a period between attacks when a subject is not susceptible to a known exciting cause, and finally the period of "potential migraine," when an attack will not arise spontaneously but will follow the action of a known excitant.

HUDDLESON, New York.

CONTAGIOSITE DE L'ENCEPHALITE LETHARGIQUE (CONTAGIOUSNESS OF EPIDEMIC ENCEPHALITIS). ARNOLD NETTER, Bull. de l'Acad de méd. Par. **83**:373 (April 27) 1920.

The author considers that a case of epidemic encephalitis which he observed was probably the first case in Paris; therefore there is special reason to believe that two other cases which developed in the same household developed with that case as the initial focus of contagion. He relates, from the experience of others, seven instances in which contagion seemed equally clear. In contrast, however, he records that though twenty-one cases of epidemic encephalitis in children were, because of lack of space, placed in general wards in the hospital, no spread of the disease inside the hospital occurred in any instance; also, among 107 cases in private families, there was only one instance of two patients in a single family. Further, he quotes figures published in England. Among 368 cases, five times only did more than one case occur in one home.

He says the contagiousness of epidemic encephalitis is difficult to prove as is that of cerebrospinal meningitis and of poliomyelitis.

He insists on the presence of the virus in the salivary glands in encephalitis. His collaborator, Henri Durand, has studied a parotid gland of a fatal case and has found in the interlobular spaces, around the vessels, excretory ducts and acini, numerous cellular masses (mononuclears). The lesions resembled those found in the same location in hydrophobia by Manouëlian. Once this localization of the virus is accepted, the saliva becomes one factor of contagion.

The author concludes:

Epidemic encephalitis is contagious. It is carried by the saliva.

By reason of the long persistence of the virus in the nerve centers the patient is for a long time capable of transmitting the affection. There are reasons for thinking it can be transmitted by a convalescent, and also by an aborted case or by a healthy person who has become a carrier. It is, therefore, necessary to search out all cases, both established and suspected. However, in our present state of knowledge one would not advise isolation when in the absence of all precaution, the great majority of cases occur singly.

DAVIS, New York.

NERVE DEAFNESS DUE TO CONGENITAL SYPHILIS IN THREE CHILDREN. M. B. KAY, J. A. M. A. **74**:1162 (April 24) 1920.

The cases reported by Kay are remarkable not because syphilis produced deafness, but because it attacked all three children of one family in the same manner, every other part of the body escaping but the eighth nerve. The ages of the children were 7, 5 and 4, respectively. The onset of deafness was between the age of 1 and 2. The blood Wassermann test of the elder child was ++++. No mention is made of the result of this test in the other two. The father admitted having had a genital lesion. The blood Wassermann test of the parents were ++++. Owing to the fact that at least a year had elapsed before signs of deafness developed, Kay believes that these are undoubtedly cases of "late hereditary syphilis." Each of the children was given ascending doses of potassium iodid, up to 35 grains, three times a day; one-half grain of mercury with chalk, three times daily, was also administered. The general result was good.

KLAUDER, Philadelphia.

L'HYPERGLYCORACHIE DANS L'ENCEPHALITE EPIDEMIQUE (HYPERGLYCORACHIA IN EPIDEMIC ENCEPHALITIS). C. Dopter, Bull. de l'Acad. de méd., Par. **83**:203 (March 2) 1920.

In agreement with other investigators, the writer has often found the sugar content of the spinal fluid increased in epidemic encephalitis. In a case which he reviews the reading was 95 cg. glucose per liter. Separation of epidemic encephalitis from various types of meningitis is at times difficult. Tuberculous meningitis, which is the type most apt clinically to simulate epidemic encephalitis, shows either diminution or absence of sugar from the spinal fluid. In syphilitic meningitis the sugar remains normal (about 50 cg. per liter).

The writer recalls that hyperglycorachia is present in diabetes, sometimes in uremia, in pneumonia and bronchopneumonia, in Malta fever, in hydrophobia, in whooping cough, in some cerebral tumors, in some hemorrhages (cerebral), in amyotrophic lateral sclerosis and in some cases of chronic cerebrospinal syphilis. Therefore it is not pathognomonic for epidemic encephalitis It is only from the point of view of differentiation of this affection from meningitis that it remains of interest.

It is found hyperglycorachia is not a constant finding in all cases. Without data on which to base an answer, the author raises the question whether it is only in cases with bulbar involvement that the sugar increase occurs.

Davis, New York.

SUR LA COMPOSITION CLINIQUE DU LIQUIDE CEPHALO-RACHIDIEN DANS UN CAS D'ENCEPHALITE LETHARGIQUE (THE CHEMICAL COMPOSITION OF THE SPINAL FLUID IN LETHARGIC ENCEPHALITIS). P. Marie and Mestrezat, Bull. l'Acad. de méd. **83**:103 (Feb. 3) 1920.

The following table is given, showing the results of chemical analysis of spinal fluids:

	Spinal Fluid Found with Lethargic Encephalitis	Spinal Fluid of Normal Persons
Albumin	0.14	0.15-0.30
Fibrinogen	0.0	0.0
Chlorids	7.25	7.30
Dry Extract	10.45	16.90
Mineral matter	8.75	8.75
Urea	0.326	0.20
Acetone	*	....
Sugar	0.94	0.53

* Very small quantity.

Other data are given to show that in lethargic encephalitis the albumin and chlorids of the spinal fluid are normal and the sugar increased while in tuberculosis and the acute meningitides, the albumin is greatly augmented, the chlorid much diminished and also the sugar greatly decreased or even absent.

P. Marie presents these figures to emphasize that lethargic encephalitis lacks the signs of meningitis. He thinks that the Kernig sign and rigidity of the neck are absent. Regarding the cell count in the spinal fluid he reports a moderate increase with 26 the highest count encountered.

Davis, New York.

ONE THOUSAND PSYCHIATRIC CASES FROM THE CANADIAN ARMY. C. K. Clark and C. B. Farrar, Canad. J. Ment. Hyg. **1**:313 (Jan.) 1920.

The authors add more facts to the evidence in favor of certain essential principles of psychiatry:

1. Satisfactory work depends, among other things, on reception wards, hospitals or beds.

2. Stress (of war) brings out in most people diseases whose causes were present in times antedating the stress.

3. Malingering is prima facie evidence of mental abnormality.

The local situation is discussed in some detail, showing how "shell shock" cases have been kept out of the older hospitals for mental diseases to which most patients with dementia praecox have gravitated.

Bond, Philadelphia.

SOME NOTES ON ASEXUALIZATION; WITH A REPORT OF EIGHTEEN CASES. Martin W. Barr, J. Nerv. & Ment. Dis. **51**:231 (March) 1920.

Barr makes a plea for the surgical asexualization of mental defectives. His strongest argument is the alarming prevalence and probable increase of this class, there being between 300,000 and 400,000 mental defectives in the United States. It is estimated that less than 40,000 of this number are being cared for in institutions.

Eighteen cases are cited to show the beneficial results of asexualization. In addition to the removal of all danger of procreation, there was also a general intellectual and behavior improvement. It is interesting to note that the legislatures of thirteen states have legalized asexualization of imbeciles, criminals and rapists.

Strecker, Philadelphia.

LE TRAITEMENT DE L'ENCEPHALITE LETHARGIQUE (THE TREATMENT OF EPIDEMIC ENCEPHALITIS). M. Arnold Netter, Bull. de l'Acad. de méd. **83**:303 (March 30) 1920.

The writer recommends the intraspinal injection of serum of cured cases in the treatment of epidemic encephalitis. Also, he recommends the administration of hexamethylenetetramine by mouth. Discussing drug therapy with arsenic and antimony, he reports one unfavorable result from the intravenous use of arsphenamin and intends to report later regarding the effects from tartar emetic.

In accordance with a belief that the virus of hydrophobia and poliomyelitis are often present in the buccal cavity, especially in the parotid and submaxillary glands, he suggests that the virus of epidemic encephalitis, a similar disease in a sense, may also be harbored there. He suggests that increasing salivary flow may hasten the elimination of the virus and therefore recommends the administration of jaborandi.

The author obviously places most value on the artificial induction of abscesses. For this purpose he injects 1 to 2 c.c. of essence of terebinthina into a buttock. He believes this procedure saved lives in the grip epidemic and that "the effect is not less marvelous in epidemic encephalitis."

Davis, New York.

LES HALLUCINATIONS LILLIPUTIENNES (LILLIPUTIAN HALLUCINATIONS). LEROY and ROGUES DE FURSAC, L'Encephale **15**:189 (March 10) 1920.

Lilliputian hallucinations comprise a variety of visual hallucinations of a particular character and, as the name implies, are small personages of a finger's height accompanied sometimes by small equally diminutive animals in the proper proportions. The patient believes that he has before his eyes a world created by Swift in Gulliver's Travels. These small personages are multiple, moving, fugitive and usually dressed in many colors. They form a veritable theater of marionettes—not flat as the figures on the screen, but in true perspective and relief. Often appearing alone, they are sometimes preceded or followed by visual hallucinations of a different, more usual kind. Though these hallucinatory midgets seem to the patient to be only a few centimeters high, he sees them capering over furniture the correct size of which is normally appreciated. In this it is not a diffuse "micropsy."

These hallucinations are usually accompanied by an agreeable affective state. They obviously amuse the person who sees them. They occur in toxic states (alcohol, chloral, ether) or in toxic infectious conditions (cholera, typhoid fever). The author agrees with Leroy, who first pointed out the toxic pathogeny of the syndrome.

DAVIS, New York.

Society Transactions

PHILADELPHIA NEUROLOGICAL SOCIETY

Regular Meeting, March 26, 1920

S. D. INGHAM, M.D., *President*

A CASE OF TUMOR OF THE LUMBAR ENLARGEMENT OF THE SPINAL CORD. Presented by DR. J. HENDRIE LLOYD.

H. Williams, B., a man, aged 43, had a negative history except for a chancre nineteen years before. His trouble began with a burning sensation in the toes of the right foot with foot drop, then numbness in the limb and motor inability ascending to the hip. There were numerous fibrillary tremors in the thigh, then pain in the sacral region and in a few weeks dysuria. Hyperesthesia of both legs then appeared; even the bed clothing distressed him. The hyperesthesia in time disappeared and was replaced by anesthesia. Complete paralysis of the bladder and bowel supervened. Six months after the onset of the disease, he was paraplegic with total paralysis of bladder and bowel. There was marked decrease in tone of the paralyzed muscles, especially of the right leg, and atrophy and active fibrillations in the affected muscles. The cremasteric reflexes were preserved; all the deep reflexes abolished. There was total anesthesia of the right lower limb behind up to the crest of the ilium, but in front only to a little above the knee; on the left side tactile anesthesia extended only a little above the ankle. There was a rather extended area of hyperesthesia above the anesthesia, and the patient complained much of pain in this area, especially in the right leg. The cranial nerves were normal. The Wassermann test of the blood and spinal fluid was negative. Roentgen-ray examination of the lumbar spine and sacral region was negative.

Evidently there was a lesion of either the lumbar enlargement or cauda equina. The onset with pain, the gradually progressive course and the rather marked unilateral character, indicated that it was a neoplasm rather than a meningomyelitis. Especially noteworthy, however, was the active fibrillation of the muscles of the thighs, such as is seen in chronic anterior poliomyelitis and which must be rare in tumor of the cord. The distribution of the anesthesia also indicated a lesion located to the right. It involved the sacral nerves and the lumbar as high as the second or third segment. The atrophy, flaccidity and abolished deep reflexes also pointed to a lesion of the lumbar cord.

The patient died a few days after admission to the Philadelphia Hospital. Necropsy revealed a large growth embedded in the lumbar enlargement; it was not a meningeal growth, but a true medullary one. The membranes were not extensively involved and the bones of the spine not at all. The appearance of the growth was that of a gumma. There were other important findings: The chain of retroperitoneal lymph glands in the lumbar region, extending down into the pelvis, was greatly enlarged, forming a huge mass.

There was an old tuberculous lesion of the apex of the right lung, and in the right lobe of the cerebellum was found a growth as large as a marble and of similar appearance to the one in the lumbar cord.

Dr. B. L. Crawford sent me this statement: "Sections of enlarged post-peritoneal lymph nodes show marked fibrosis with areas of caseation and intense mononuclear cell infiltration. The cells are more numerous at margin of nodes, and in places form small foci containing giant cells.

"The cross section of enlargement in the caudâ equina shows a diffuse fibrosis and necrosis, with intense mononuclear cell infiltration at outer margin of cord and in the meninges, forming numerous foci in which giant cells may be seen. No nerve fibers remain.

"Section of nodule at base of brain shows a similar chronic inflammatory process, fibrosis, necrosis, mononuclear cell infiltration, giant cells and localized meningitis.

"Diagnosis: Chronic fibroid and caseous lymphadenitis, tuberculous, post-peritoneal. Tuberculoma in cauda equina and in cerebellum, under the surface of the right lobe with localized meningitis."

Dr. Crawford said: "I have termed the lesion in the cord tuberculous. I realize the strong possibility that it may be syphilitic, but in view of the widely disseminated tuberculosis elsewhere, I consider the diagnosis the more logical. I have been unable to demonstrate tubercle bacilli in the section." He said that he had not had an opportunity to stain the spirochetes.

Was the cord lesion tuberculous or syphilitic? Pathologists seem to agree that it is not always easy to distinguish these two conditions. The intense lymphocyte infiltration is much like that which is seen in gummas — most marked in the membranes and outer portions of the growth and in the walls of the vessels. Giant cells are also not unknown in gummas.

Solitary tuberculoma of the spinal cord has been observed. In a series of fifty cases of cord tumor, tabulated by Dr. Mills and the writer in Pepper's "System," four such cases (or 8 per cent.) are noted. Nevertheless, in the present case I favor gumma. The coexistence of syphilis and tuberculosis in the same patient has been observed, and in a recent paper Dr. E. H. Funk of this city (*Penn. M J.*, March, 1920, p. 310) says that such coexistence is not uncommon. The presence of a large mass of caseating tuberculous lymph glands in the retroperitoneal space is therefore not altogether conclusive evidence that the cord tumor is not a gumma.

DISCUSSION

Dr. S. Leopold said there was no way of diagnosing this specimen except by staining for the organism. He said he noticed in the lymph node the daughter tubercles which he did not think were found in a gumma. He thought, therefore, that this was a tuberculoma rather than a gumma.

Dr. W. G. Spiller said he was much more inclined to think that the growth was a tubercle. Tubercles were often multiple, occurred in different parts of the nervous system and were not uncommon in the cord. A distinct gumma of the cord was of great rarity. Dr. Spiller said he had not in his collection of over 800 specimens a single gumma of the spinal cord; he was not referring to gummatous meningitis.

Dr. J. Hendrie Lloyd said that he did not understand how any one could be dogmatic about the tissue under the microscope. It was an amorphous, breaking-down tissue, undergoing fibrosis, and around the edges there was

intense small cell infiltration, which was characteristic of gumma. Dr. Lloyd found that the greatest reliance was placed by pathologists on the presence of giant cells. There, he confessed, the appearance would indicate that it was tuberculous, although giant cells are also seen in gumma.

THE CLINICAL INVOLVEMENT OF THE PERIPHERAL NERVES IN DIABETES MELLITUS. Dr. Walter M. Kraus.

Dr. Kraus presented the results of a statistical survey of 450 case reports of diabetes mellitus. They were selected from nearly 700 accumulated during ten years in the Metabolic Department of the Vanderbilt Clinic, New York.

The discussion was limited to those cases having symptoms pointing to disease of the spinal cord or peripheral nerves. The symptoms and signs considered were: areflexia, neuralgia, ulceration and gangrene, pseudotabes, spinal cord disease, herpes zoster and peripheral neuritis.

Absence or diminution of knee jerk on one or both sides was found in 30 per cent. of the cases; exaggeration 10 per cent. The Achilles reflexes were absent in 64 per cent. of the cases tested (8 per cent.).

Age, sex, race, nutrition (determined by loss of weight and the weight-height index), duration of the disease, condition of the arteries and the blood pressure appeared to play no part in determining hypoflexia or areflexia. The severity of the disease, as determined by the course and carbohydrate tolerance, seemed to play a part since knee reflexes were absent in 22 per cent. of the mild cases, 33 per cent. of the moderately severe cases and 50 per cent. of the severe cases. Neuralgic pains were present in the extremities in about 25 per cent. of the cases.

Cases showing changes in light touch sensation and reflexes with some neuralgia, were not uncommon. Probably these symptoms were due to spinal cord involvement. This had been shown pathologically by Williamson, Kalmus, Schweigger and others. These cases were not "neuritis." Peripheral neuritis in diabetes is rare. None of the pathologically reported cases were true sensorimotor peripheral neuritis. In the 700 cases at the Vanderbilt Clinic there was only one. The patient was also alcoholic. The coincidence of alcohol in the few cases showing peripheral neuritis is emphasized by all writers on the subject.

Ulceration and gangrene occurred in few cases. Herpes zoster in none.

The cases showing absence or diminution of deep reflexes, sensory changes in the skin, neuralgia and ataxia (diabetic pseudotabes) can all be explained anatomically by a partial lesion of the intramedullary portion of the posterior roots. The changes in the posterior columns follow. Gangrene may have the same origin.

DISCUSSION

Dr. W. B. Cadwalader said that if an endogenous toxic process is assumed to be going on in the posterior columns of the cord in cases of diabetes resembling that found in pernicious anemia, the loss of the tendon reflexes should not be expected until after the sensory symptoms become firmly established. In pernicious anemia the tracts situated close to the midline in the posterior columns are affected early and as the process extends laterally the fibers of the reflex arc are destroyed late and the patellar tendon reflexes, which are generally exaggerated at first, become diminished or lost entirely. In Dr. Kraus' cases of diabetes the tendon reflexes were lost early and the

mild sensory changes developed later, so that this order of development of symptoms would suggest a morbid process beginning in the region of the posterior root entrance zone of the spinal cord and extending toward the midline—exactly the reverse to the order in which the signs of pernicious anemia develop. It would be interesting to know whether in certain cases patients with diabetes, when profoundly toxic and without tendon reflexes, recovered their tendon reflexes when toxemia disappeared.

Dr. S. Leopold said there was one diagnostic point that might be considered. As none of Dr. Kraus' patients had come to necropsy, he would like to ask whether he had performed lumbar puncture on any of them. In the exogenous changes one usually finds a round cell infiltration and an increased number of cells in the spinal fluid. If endogenous, the spinal fluid should be negative.

Dr. Kraus said that Williams of Manchester, England, who has done the most work on the subject, believed that the posterior roots were affected exclusively in their intramedullary course.

The patients in question recognized the position of their fingers and toes quite well.

The pains were thought to be due in some cases to arteriosclerosis. The only positive finding obtained from the records was that the knee-jerks were absent twice as often in severe cases as in mild cases.

TUMOR OF THE CRANIUM IN THE PARIETAL REGION. Presented by Dr. John H. W. Rhein.

S. M., colored, aged 49, with negative family and previous history, seven years ago was struck by a club over the left parietal region. Two years later a small tumor appeared at the site of the injury, which gradually grew larger, more rapidly in the last two years. Two years ago, he had a convulsion, probably general. He was confused for two hours after the attack, his speech was thick, his right arm and leg were powerless. He complained of numbness in the right hand for a week or two and dragged his right foot. This was followed by several attacks in which the right side of the face would twitch, there was some disturbance of speech, and he could not express himself clearly. The attacks were preceded by pain in the right parietal region at the site of the tumor. These minor attacks occurred about twice a month.

In the autumn of 1918, he had a second convulsion. The right arm and leg have remained weak ever since. He had a third convulsion in the summer of 1919 and a fourth in October. During these attacks he twitched on the right side only. Since the attack in the summer of 1919, he has had difficulty in recalling words, dates, etc. He becomes confused when going out into the street and is not able to find his way home.

When he presented himself on November 11, he complained of not seeing well, difficulty in recalling words and pain in the tumor over the left parietal region. Examination revealed: The tongue was protruded in median line; both sides of the upper and lower face moved equally well and the masseters were normal. The right pupil was slightly larger; both responded promptly to light and in accommodation. There were no sensory disturbances in the face. The dynamometer registered 100 on the right, 115 on the left. The arm reflexes were prompt and equal, knee reflexes were increased more on the right than on the left. The right ankle reflex was more active than the

left. Station was good. In walking, the right leg was suggestive of the hemiplegic gait and was distinctly weaker than the left. There were no atrophies. Astereognosis was present in the right hand. He felt the pin prick equally well on both sides, but examination of the sensation was not entirely satisfactory owing to a somewhat disturbed mental condition. The Wassermann reaction was moderately positive. The eyegrounds were negative. Hypermetry was present on the right side. Roentgen-ray examination revealed an extensive lesion in the right parietal region covering an area of 6 inches in length by 4 inches in width, showing overgrowth of bone and a destructive process. The tumor was immobile, somewhat soft in places but not fluctuating. The integument could be moved fairly well over the tumor. It was not sensitive and did not pulsate. The tumor measured 13 cm. in its anteroposterior diameter and 10 cm. in its transverse diameter.

On Jan. 3, 1920, the patient had an attack in which he lost consciousness, followed by paralysis of the right arm and leg and inability to talk, which lasted for two days. In a week he was able to walk, dragging his foot; the right arm was weak.

On January 18, Dr. Appleman found a right homonymous hemianopsia. The eyegrounds were normal.

On February 24, a short time after a convulsive attack, it was noted that the lower part of the face on the right side was paralyzed. He dragged his foot; the grasp on the right side was weaker, and he exhibited marked apraxic phenomena. In attempting to comb his hair, he made stroking movements 3 or 4 inches away from his head. When asked to brush his clothes with a clothes brush, he made purposeless movements in the air. A key was placed in his hand and he was asked to unlock a door. Instead of the proper movements, he placed the key on his nose or made purposeless, irregular movements, pointed at the door and suddenly, after a long effort, plunged the key spasmodically into the keyhole, after balancing it before the keyhole and assisting with the left hand. The Wernicke pupillary inaction was not present. He could not answer questions intelligently, apparently because he could not recall the proper words. He was able to read letters but was agraphic.

Examination on March 26 showed that the right arm was distinctly weaker than the left. There was practically no evidence of apraxia. The reflexes were increased everywhere, and there was a tendency to ankle clonus. On the right side there was no plantar reflex and no Babinski on either side. The abdominal reflexes were active. Otherwise, there was no change in his condition.

The diagnosis in this case rests between sarcoma of the giant cell type and syphilis. He was given mercurial inunctions up to the point of salivation and a thorough course of iodid of potassium without being benefited. He refused intravenous treatment with arsphenamin. In view of the negative result of the antisyphilitic treatment, it was concluded that the case was probably one of sarcoma of the bone which produced pressure on the brain beneath the site of the tumor.

Cases reported by von Bechterew, Strohmayer and Abraham, in which the lesions were in the posterior, central and lower parietal regions, showed that implication of the brain in these regions, which are the sites of pressure in this case, may give rise to apraxic symptoms. The hemianopsia is more difficult to explain. If the pressure was sufficiently great in the parieto-occipital region it could be explained on the basis of involvement of the optic radiations. Another possibility is that there has been, as a result of a convulsive attack, a cerebral hemorrhage with implication of the optic radiations.

The question of operation arises. If the case is one of giant cell sarcoma, the possibility of the complete removal of the tumor offers the patient a chance of recovery. Without an operation, the case appears to be practically hopeless. I think the patient should undergo an operation to have the tumor removed. I know of no malignant growth of this type which would last as long as this except the giant cell sarcoma, which is the least malignant of all sarcomas. If his diagnosis is correct, the symptoms must be due to pressure by bony growth and not a metastasis, as the latter is not known in giant cell sarcoma.

DISCUSSION

Dr. J. Hendrie Lloyd said he did not see that there was any difficulty in explaining hemianopsia in these cases. An external lesion making deep pressure in that region will be pretty sure to involve the optic radiations and thus cause hemianopsia. Agraphia is usually secondary to word blindness because the faculty of writing depends primarily on the faculty of reading.

Dr. Charles W. Burr said there is a man now at Blockley Hospital with a tumor of the palatal bone, which on his admission had grown upward and affected the base of the brain. He was so weak, not palsied, that he was bedridden. The growth so encroached on the cavity of the mouth that he could scarcely swallow and had to be fed by a spoon with liquids. Speech was impossible. After treatment by radium, the visible size of the growth decreased more than two-thirds. His strength returned so much that he was able to get out of bed, walk and take care of himself. He still has the sarcoma, but life has been made not only bearable but comfortable. Dr. Burr thought it would be worth while for Dr. Rhein to put his patient on radium treatment.

Dr. S. D. Ingham remarked that there was one feature of the case on which he had heard no comment; the absence of choked disk, and to a large extent, of general symptoms of intracranial pressure. It appeared to him that this could be explained by what might be called spontaneous decompression. The erosion of the parietal bone shown in the roentgenogram permitted the large cerebral hernia and prevented any high degree of intracranial pressure.

Dr. John H. W. Rhein said that the tumor seen in his patient was not entirely a bony growth. The skull around the tumor showed some proliferation but in other parts there was a distinct loss of bony tissue. It did not correspond, in his opinion, to the appearances presented by hemicraniosis. It was more likely to be a sarcoma.

ORBICULARIS TIC ATTRIBUTED TO OCULAR IRRITATION BUT DUE TO A RETREAT MECHANISM. Presented by Dr. Tom A. Williams.

A woman, aged 50, was referred by an ophthalmologist because of an obstinate, almost spasmodic contraction of the orbicularis, which had ensued two years before while nursing her sister. It was preceded for a few days by pain in the left eye and for a year by a feeling of uneasiness, which she attributed to faultily fitting spectacles. When she began to screw up her eyes she was chafed by a friend. This caused extra efforts to master the

movement, which only made it harder. Lacrimation had lasted a year, though she did not think it was due to the muscular contractions. Several changes of glasses caused no improvement, nor did the constant attention of her husband and friends, and the withdrawal from activities.

Examination revealed sunken eyeballs; active reflexes; increased myotatic reaction; blood pressure: systolic 176, diastolic 118; urine, specific gravity 1.004, with no albumin; blood nitrogen 75 mg. There had been severe headaches the preceding summer and neuralgia and headaches intermittently since the age of 12. Insomnia was distressing. She had always been timid and blushed a great deal; even now the neck flushed during the interrogation.

The most significant feature of the case, however, was that all her life when she wished to shut out an annoying circumstance she had made it a practice to close her eyes when thinking it over. In a crowd at times she would even close her ears to shut out extraneous stimuli which might prevent concentration and adequate reaction to circumstances.

In view of the absence of kidney disease, and in spite of the high blood pressure, and an appearance much older than her years, reeducation was attempted. Various experimental reactions were observed, and she was taught to relax her forehead, and latterly the orbiculares themselves. She was seen every day for two weeks and her psychologic difficulties were rectified in the course of this period. She was made to write out each evening the results of the interview of the day. In addition she was given eliminative baths, compound thyro-ovarian tablets and a low protein diet. Blood pressure eventually fell to systolic 155, diastolic 104. She steadily gained control. She went home in a month, able to read, to go on the streets and to stand considerable stress without the occurrence of the tonic tic which had incapacitated her for two years. There were still occasions, however, when complete control was lacking, but Dr. Williams did not consider it expedient to keep her longer, believing that complete restoration would occur before long.

LACRIMOSITY DISASSOCIATED FROM EMOTIONAL FEELING, WITHOUT APPARENT LESION. Dr. Tom A. Williams.

A clerk, aged 30, had complained of mild headaches for nine months. Three months ago choking and gasping attacks began, with sobbing periods, of which there were about a dozen. Latterly the headache had become constant and more severe at times. He had lost inclination to work, had skin eruptions and an obstinate ulcer of the right foot. There was a history of venereal ulcer ten years ago and he is supposed to have had syphilis in the Philippines, but several Wassermann reactions have been negative.

The reflexes were feeble, especially the right patellar and the left Achilles. There were no other abnormalities. Dr. Williams began provocative injections of arsenic and followed them ten days later by a full dose of neo-arsphenamin. Next day examination of the spinal fluid showed a negative Wassermann and colloidal gold reaction, no increase of albumin, and only two lymphocytes per cubic millimeter. It is perhaps safe, therefore, to exclude meningeal syphilis. The patient insisted that several of the attacks of crying have occurred without the least feeling of sadness or emotion of any kind. In this respect the case is most remarkable, as there are no signs whatever of organic disease, except the preceding symptom and the headache, and there is not the faintest resemblance to the pseudobulbar type of reaction, except in this respect.

A CASE OF PITHIATIC PARAPLEGIA, IN AN EX-SERVICE MAN, ILLUSTRATING RAPID REEDUCATION AT HOME. Dr. Tom A. Williams.

An engineer, aged 37, was seen in Virginia in February, 1920, in consequence of complete paraplegia of three days' onset and ten days' duration. There was a history of paralysis of eight months' duration three years before, after injuring his spine, cured by four months' manipulation. He attributed the present attack to the intense strain of organizing a union. He complained of no pain, only numbness with complete incapacity. Other than a blood pressure of 100 there were no physical abnormalities, all the reflexes being present and normal.

A gradual reeducation was immediately begun in a small cabin in the country in which he was living. One after another the various segments were placed in movement by the patient under strong persuasion, and before Dr. Williams left the patient walked three times around the room. The case is reported, not as a novelty, but to illustrate that even under the most unfavorable conditions rapid reeducation is possible in certain pithiatics.

UNUSUAL SENSORY DISASSOCIATION, DUE TO ORGANIC DISEASE. Dr. Tom A. Williams.

A college student, aged 20, in December, 1918, felt exhausted. In May, 1919, the sight of the left eye became dimmed. In June, supervened fainting attacks with rigidity and spasms, following numbness and dull sensations in the feet, and followed by an unsteady gait. A few months later another attack occurred; she has been unable to walk since that time. When seen in February, 1920, she presented a typical picture of disseminated sclerosis; namely, exaggeration of the deep reflexes, plantar reflexes extensor, abdominal reflexes absent, violent intentional tremor, nystagmus on looking laterally along with slow conjugate deviation, pallor of the left optic disk, especially temporally; poorly maintained contraction of the pupils to light, especially the left, and slow slightly slurred speech. She was mentally clear and there were no emotional disturbances.

The lower limbs were insensible to deep pain and vibration, and a pin prick was scarcely felt as such below the upper third of the thigh. Localization, however, could be made and the temperature sense was retained, not only to heat and cold, but to warmth and coolness. The spinal fluid gave a negative reaction to the colloidal gold and to the Wassermann tests, but there was a slight increase of protein, and seven lymphocytes to the c.mm.

Disassociation of temperature sense and that of pain is unusual except over minute areas in syringomyelia. Head has figured some cases of this kind in a well-known study.

PARALYSIS OF ASSOCIATED UPWARD AND DOWNWARD MOVEMENTS OF THE EYEBALLS. Presented by Dr. Williams B. Cadwalader.

J. W., aged 16, had always been healthy until June, 1919, when he first complained of disturbances of vision. In November, 1919, he was struck by an automobile and knocked down, but there were no evidences of injury other than mild contusions. He seemed well for about a month after the accident and then began to complain of bilateral temporal headache and tremor of his right hand which interfered with writing.

The patient was seen Feb. 24, 1920. The right pupil was larger than the left; neither reacted to light, and they contracted incompletely and sluggishly in accommodation and in convergence. The eyeballs could not be elevated at all above the horizontal plane; they could, however, be moved downward slightly but not more than one third of the normal range. All other ocular movements were normal.

Dr. Deichler reported that there was complete paralysis of the superior rectus muscle and decided paresis of the inferior rectus muscle of each eye. The vessels of the right eye were smaller than normal and the disk was slightly swollen along the nasal border. The left eye was normal.

The right upper limb was distinctly ataxic. His hand writing was tremulous. The biceps and triceps reflexes were slightly increased on the right side, normal on the left. There was no weakness of either upper extremity. Station was normal, but there was distinct ataxia and awkwardness of the right lower limb with a tendency to go toward the right. The patellar and Achilles reflexes were increased on the right, and abortive ankle clonus was present on the right. The plantar reflexes were normal.

One month later the right optic disk showed slight swelling; the left was still normal.

No other abnormalities were found. The headache was not severe and not constant; neither nausea nor vertigo was present. Other cranial nerves were normal; sensation was normal. The patient's general health and intellectual attainments were much better than the average.

Because of the loss of upward movements and weakness of the downward movements of each eye, it is probable that there is a lesion, perhaps a tumor, in the vicinity of the third nerve nucleus of each side or of the corpora quadrigemina. According to the history obtained, the patient must have had some ocular disturbance about a year ago, but the incoordination of the right extremities does not seem to have attracted attention until December, 1919.

DISCUSSION

Dr. J. Hendrie Lloyd asked whether convergence had been tested. He thought that paralysis of convergence had usually been associated with paralysis of upward movement in the reported cases.

Dr. W. B. Cadwalader said that the patient's symptoms were gradually growing more pronounced. Convergence seemed to be paralyzed almost completely.

BILATERAL LENTICULAR DISEASE. Presented by Dr. George Wilson.

A boy, 10 years of age, was born at full term. Labor was easy, and he was not blue at birth. He walked at 5 and had only recently begun to talk. The family history was unimportant.

He was examined because of irregular movements and speech defect.

Examination.—The boy was well nourished. Station was normal. The gait was stiff and punctuated by the general bodily movements which occurred at irregular intervals. The ocular nerves, the pupils, the eyegrounds and fields and hearing were normal. There was no nystagmus. The speech was explosive and dysarthric and dysphagia was present. A spastic grin appeared frequently. All reflexes were presented and prompt, there was no ankle clonus. Plantar stimulation produced plantar flexion although at times extensor response was obtained on the right. The abdominal reflexes were normal. The

extremities were hypertonic but not distinctly weak. Sensation in all its forms was normal; there was no astereognosis. The muscles of the face, the upper and lower extremities were all at times involved with a type of movement that seemed to be a combination of athetosis and chorea. The various laboratory tests and the general medical examination were negative.

The movements, dysarthria and dysphagia and hypertonicity of the extremities without marked weakness or positive evidence of pyramidal tract disease led Dr. Wilson to believe that the patient had involvement of the lenticular nuclei.

DISCUSSION

Dr. Charles W. Burr said he had seen this boy at the Children's Hospital, and his impression at that time was that he was suffering from congenital cerebellar disease. The boy was like a miniature edition of Hiram at Blockley; the spasmodic movements of the face, the speech, the athetoid movements and his gait, were all similar.

Dr. W. G. Spiller said that athetosis in the early stage was often overlooked. He had referred many times to a boy who had come to him at 5 years of age in much the same condition. He was now about 20 and in the Home for Incurables, and had developed extreme spasticity and athetosis. Dr. Spiller thought the patient shown probably had a lenticular lesion.

PHILADELPHIA NEUROLOGICAL SOCIETY

Regular Meeting, April 23, 1920

Samuel D. Ingham, M.D., *President*

TWO CASES OF MEDIAN NERVE INJURY. Presented by Dr. N. W. Winkelman.

The first was that of a man, aged 80, who thirty-five years before had had an injury to his left thumb whereby it had been turned backward on the wrist. A few years later he noted, especially in cold weather, a numbness in the palmar aspect of the outer three fingers and the outer side of the fourth finger and also numbness around the nails. Twenty years after the injury pain began in the thumb. At first it was not severe, but within the last year it has become marked, the pain being sharp and more or less constant. Examination showed distinct atrophy of the abductor pollicis, opponens pollicis and part of the flexor brevis pollicis. Motion and power in the hand were good; sensation was but slightly reduced in the proximal part of the thumb though the distal end was hypersensitive; the skin was distinctly shiny. Near the end of the thumb on the anterior aspect was a small pulsating tumor which was evidently an aneurysmal dilatation. Roentgen-ray examination was negative.

The second case was that of an ex-soldier who sustained shrapnel wounds of the right forearm just below the elbow on the radial side. He also showed the same median nerve atrophy of the abductor pollicis, opponens pollicis and part of the flexor brevis pollicis as the patient in the former case but not so marked. Reactions of degeneration were obtained in these muscles. He also had shiny skin and curved nails in the three outer fingers. The sensory disturbances were more marked but were due to involvement of superficial nerves.

DISCUSSION

DR. ANDREW H. WOODS mentioned a device for testing the action of the opponens and short abductor of the thumb which he had found useful. The patient was told to hold the hands in a horizontal plane with the palms upward, and then to raise the thumbs into a vertical position "like a tent-pole." The movements of the normal hand were for comparison. With a normal median nerve the vertical position of the thumb can be nearly or completely attained; but any weakness of innervation shows itself by the thumb being carried across the palm by the abductor and lower half of the short flexor, and in a position nearer the palm in proportion to the weakness of the median nerve action.

PERSISTENCE OF NEURALGIC PAIN IN THE TRIGEMINAL REGION AFTER AVULSION OF THE SENSORY ROOT. Presented by DR. ANDREW H. WOODS.

Dr. Woods referred to the satisfactory results almost uniformly following avulsion of the sensory root of the trigeminal nerve for neuralgia. The exceptional cases in which pain persisted raised the question as to the existence of other afferent nerve fibers from the face to the central nervous organs. Muscle sense and pressure sense are considered by good authorities to be conducted by the motor root of the trigeminal and by the facial nerves. The glossopharyngeal and vagus may cause confusion in these neuralgic cases when the areas involved are around the ear or in the pharynx.

A patient was presented in whom, after a compound fracture of the right mandible seven years earlier, violent neuralgic pains had continued unabated in spite of neurectomies and avulsion of the sensory root. Angioneurotic edema chiefly of the right half of each lip and the right eyelids had recently occurred, and there was sympathetic palsy of the right eye. An exquisitely sensitive area existed on the oral aspect of the broken jaw, any contact with which started "electric pains" in the lower jaw, referred especially to that sensitive spot. The skin and mucous membranes of the right trigeminal area, except part of that of the ophthalmic branch, did not perceive touch, prick, heat, cold or pressure; but these stimuli usually set off the electric pains. Pressure over the region of the superior cervical ganglion was painful and started the paroxysms. In brief, the essential phenomena of causalgia were present. Dr. Woods felt that there was reason for suspecting the sympathetic nerves in this case and he had recommended that before attempting further intracranial operations an effort be made to dissect off the periarterial plexus of the external carotid artery; or if that failed, to extirpate the superior cervical ganglion.

DISCUSSION

DR. S. D. INGHAM said that this had been a particularly interesting case to him because he had seen a number of cases of causalgia caused by injuries in which the nerve had been completely severed, followed by pain in the distribution of the nerve and excited by peripheral irritation in its distribution. This had been substantiated by operations in which the nerve had not only been exposed, but the stumps had also been resected and still the pain in the distribution of the interrupted nerve persisted. There is a great deal of evidence that there is some side track through which pain impulses can reach the seat of consciousness from tissues, the principal sensory nerve of which has been interrupted. The sympathetic or vegetative nervous system has been shown to possess pain fibers. It is a question whether they should be called

sympathetic fibers or whether they are not truly spinal nerves, accompanying the sympathetic and having their cells within the posterior ganglions. Practically all the viscera are supplied with fibers which under certain conditions excite pain, and which must accompany the sympathetic nerves.

A CASE OF HEMIPLEGIA IN A CHILD WITH UNUSUAL SPASMODIC MOVEMENTS. Presented by Dr. C. S. Potts.

History.—Esther, aged 12, was referred to the clinic for nervous diseases of the Polyclinic Hospital by Dr. J. K. Young, on March 8, 1920.

Her mother, father, three sisters and two brothers were living and well. The patient was well until the age of 5, when she was ill with scarlatina in the Municipal Hospital for Contagious Diseases for three months; after this she was paralyzed on the right side and had tremors. Her history while at the Municipal Hospital was not obtainable.

The patient was mentally bright and had reached the sixth grade in school. She was emotional under observation. Her motor disturbance had, however, steadily grown worse, markedly so during the past year; for the past two months she had been unable to attend school. She had never had a convulsion.

Physical Examination.—She was well developed but had never menstruated. The thyroid was somewhat enlarged. The diminution in strength on the right side was not great, but there was marked spasticity, especially when using the limbs. The right leg was 1 inch shorter and the right arm 1½ inches shorter than the left. Below the knee the right leg was 1 inch less in circumference than the left. The arms and thighs were about the same. The knee jerk was greater on the right side. Ankle clonus was not present and the Babinski reflex was absent.

At times while at rest there were athetoid movements of the fingers of the right hand, but when the patient walked the arm was markedly drawn up in flexion and the hand grasped by that of the left side. At the same time, there was marked tonic contraction of the left sternomastoid, and this muscle seemed to be somewhat hypertrophied. Contraction could also be felt in the muscles of the back of the neck on the right side. The head was turned to the right and pulled over until it nearly lay on the right shoulder and slightly backward. The chin was not elevated. At times, when the patient was excited the arm and leg became rigid and fine clonic contractions occurred.

Were the movements of the head organic in origin or hysterical? Dr. Potts believed that there was probably an organic basis but that hysteria played a large part in exaggerating the symptoms. While simulating a torticollis the position of the head was not typical. If organic, would cutting the left spinal accessory and posterior cervical branches on the right side be of benefit?

The case apparently showed that in turning movements of the head the sternomastoid is innervated from the cortex of the same side. The fact that muscular strength was not much impaired and the Babinski reflex absent brings up the question of the possibility of a lenticular lesion.

DISCUSSION

Dr. Charles K. Mills said that it looked to him like a lenticular case. Regarding the forms of sternomastoid spasm or tics, after having had a score of patients operated without benefit, in the course of years, he believed that operation was not desirable. In the case presented by Dr. Potts the child

exhibited far more than simple movement of the spinal accessory distribution, for there were more or less involved complex rotary movements of the head and trunk.

Dr. S. D. Ingham said that in the case of paralysis or motor disturbance of cerebral origin outside of acute irritative lesions it was uncommon to have marked spasmodic actions as constant as those exhibited in Dr. Potts' case. Also, bilateral groups of muscles were not commonly affected from cerebral paralysis. Cerebral injuries cause irritation in unilaterally combined groups of muscles. It seemed to Dr. Ingham that the torticollis element of this case was largely of a psychic rather than an organic character and if this were so, operation would probably be worse than useless.

Dr. J. Hendrie Lloyd said that this case partook of the nature of athetoid movements. It was rather peculiar in the violence of the movement in the neck muscles, giving the child a rotary motion. Dr. Potts and others present would remember the classical case of Hiram at the Philadelphia General Hospital, in whom the sternocleido muscles stood out because of overdevelopment from exercise.

Dr. Potts said that he thought there was a psychic element in the case, but there was a question in his mind as to whether there was not an organic basis for it. He felt inclined to believe that probably there was. In regard to the bilateral character of the muscular contractions in turning the head, it must be remembered that this was an associated movement and such muscles may be innervated from the same side, as in lateral movements of the eyes for example. Dr. Spiller before the meeting stated that he believed that the sternomastoid muscle was innervated from the same side of the brain as it appeared to be in this patient. In regard to operation, Dr. Potts thought it offered a chance of relief, but he could not make up his mind to recommend it. The child seemed to be incapacitated for doing any useful work, which before this condition developed she was able to do. She had had large doses of bromids without results. Dr. Potts said he might try atropin; he had written a paper some years ago on the good effects of this drug, as recommended by Leszynsky but he had not thought of it in this case.

BOSTON SOCIETY OF PSYCHIATRY AND NEUROLOGY

Regular Meeting, April 15, 1920

Everett Flood, M.D., *President*

ROENTGEN RAYS OF INFLATED VENTRICLES DISCLOSING A BRAIN TUMOR. Dr. William Jason Mixter.

The first case I present is one in which I consider I made a definite mistake, with a fatal result. It was one of unlocalized brain tumor in a child, presumably cerebellar, with internal hydrocephalus, an almost decerebrate animal according to symptoms. The roentgen rays did not reveal anything definite in the way of a tumor although a shadow could be seen in the center of the cranium. Roentgenograms made after the cerebrospinal fluid in the ventricles had been replaced by air under atmospheric pressure showed a different picture, for a large tumor mass presented itself distinctly. This injection of the ventricles has been done by Dandy a considerable number of

times, I think without as yet a fatal result. Unfortunately, my first case was a fatality, the child dying within twenty-four hours. My feeling is that the mistake was made in letting in too much air. I think death probably was due in part at least to change in the pressure of the cerebrospinal fluid. At necropsy a large tumor of the pineal gland was found.

Surgical Treatment of Meningitis.—Some four years ago I operated on a patient with cerebrospinal meningitis and tapped the ventricles, replacing the infected fluid with serum. The patient received this treatment six times and made a practically uneventful convalescence. Previous to the intraventricular treatment he had had numerous spinal treatments and the cerebrospinal fluid by lumbar puncture was negative. The case showed a mild grade of choked disk and definite though mild symptoms of increased cranial tension. The case was reported by Dr. Hoch in the *Boston Medical and Surgical Journal.*

When in France I was much interested in a case of cerebrospinal meningitis in a nurse who finally died of a chronic type of this disease three months after her original infection, having shown no evidence of increased tension or definite evidence of infection, involving the upper meninges. At necropsy her ventricles were found to be filled with a turbid fluid showing meningococci in large numbers. If I remember rightly there was practically no infection in the tissues of the lower spine. She did, however, have an abscess in the spinal cord. She was not given this ventricular treatment.

A short time ago Dr. Ayer asked me to see a patient with cerebrospinal meningitis whom he had been treating for some days, first with lumbar puncture, later with cisterna puncture, who had at first responded well to treatment and after a time had not responded although the cerebrospinal fluid by lumbar puncture was negative. Exploration of the ventricles showed turbid fluid. The patient was treated twice by injecting into the ventricles about 40 c.c. of serum, and she is now ready to leave the hospital.

These cases to my mind are rather significant. In patients with cerebrospinal meningitis who are not reacting to treatment but are still having temperature and especially an increased white count notwithstanding the absence of organisms in the cerebrospinal fluid, I think that ventricle puncture, even if only for diagnostic purposes, is indicated. It is not, as a rule, a difficult operation.

DISCUSSION

DR. JAMES B. AYER: It was my privilege last year to do a great deal of work on experimental meningitis. In the animals on which we experimented we found that within twenty-four hours after meningitis had commenced the greater number showed also ventricular infection. It is not known whether or not this early and frequent infection of the ventricles is true of man, but owing to the greater depth of the velum interpositum and velum medullare in man, by which it is presumed infection reaches the ventricles, it is probably less frequent and less early than in the experimental cat or rabbit. However, there is reason to think that the organisms usually reach the human ventricle provided the meningitis lasts long enough. In this case, the meningitis had lasted for three weeks in spite of vigorous treatment with a known effective serum. If, as in the animal, it is possible for ventricular infection to occur in twenty-four hours, or several days, it is unreasonable to treat patients indefinitely by lumbar puncture, or even by the more direct cistern puncture. The ventricles must be reached directly. What shall be our guide as to when

ventricular exploration shall be made? If after a reasonable amount of treatment by the subarachnoid route with a serum of known efficacy in the case at hand, either (1) the organisms persist in the spinal fluid or (2) the organisms disappear, but symptoms of acute meningitis persist, it is probably wise to investigate the ventricles.

THE ANATOMIC IMPLICATIONS OF INTROSPECTIVE PSYCHOLOGY. Dr. Harold I. Gosline.

Introspective psychology is not an "arm-chair" psychology but was developed and is being added to by laboratory methods. It had its inception in the first psychologic laboratory established by Wundt in 1876. Corresponding to this beginning and to its aims, this form of psychology is built up like any other science. It makes certain fundamental assumptions its postulates and builds around these, assuming them to be true till some experience is reached which is not in accord with the postulates. Until then the postulates must stand as the truth.

On the basis of this psychology an analysis of personality is presented which reduces the complex mental functions, inner states, activities, ideas and perceptions into simple mental processes, sensations, associations, reactions and inhibitions.

If this idea of introspective psychology is the truth, the author supposes that it can be made the basis for some conceptions of nervous system anatomy, which were then presented.

THE STATE INFIRMARY. Dr. J. H. Nichols.

Dr. Nichols read a paper on the State Infirmary at Tewksbury, Mass., giving the history and development of that institution from the time of its inception, with a description of the present scope of its activities.

Book Reviews

SHELL-SHOCK AND OTHER NEUROPSYCHIATRIC PROBLEMS. Presented in Five Hundred and Eighty-Nine Case Histories, from the War Literature, 1914-1918. By E. E. Southard, M.D., Sc.D. Bibliography by Norman Fenton, S.B., A.M., Sergeant, Medical Corps, U. S. Army; and an Introduction by Charles K. Mills, M.D., LL.D., Emeritus Professor of Neurology, University of Pennsylvania. Cloth. Price, $10. Pp. 982, with illustrations. Boston: W. M. Leonard, 1919.

Whether or no the participants in the World War will have the acumen to profit by the lessons taught by that great conflict, is one of the vital questions of the day. Dr. Southard in the present work tried to contribute his share to an affirmative answer. He lived to see his book in print, but not to view the harvest sprung from his sowing.

The author calls the work a compilation. So it is; but it is more. Not only are there case records (589 of them) from the literature of many countries covering every phase of war neuroses and psychoses, but there is an epicrisis that gives an excellent digest of the enormous clinical material. The discussion is psychologic and psychiatric, philosophic and practical, expounding principles and also indicating the clinical steps essential to avoidance of errors. Treatment and results are adequately covered.

Besides being an altogether unusual exposition of the nervous disorders of the great war, it should be most valuable to those engaged in reconstruction work. The physician engaged in civil practice only may also learn priceless lessons from this book.

The first 265 pages (Section A) contain clinical records (from the literature) representing eight groups of disorders or defects that influence or complicate war neuroses or psychoses. These are (1) those patients in whom syphilis possibly or certainly plays a rôle, (2) the feeble-minded group, (3) the epileptic group, (4) the alcohol-drug-poison group, (5) the group with focal brain lesion, (6) the symptomatic group, (7) the presenile group (no cases) and (8) the dementia praecox group.

Section B (251 pages) in the same way covers shell-shock, its nature and causes; Section C (142 pages), shell-shock, diagnosis; Section D (156 pages), shell-shock, treatment and results; and Section E (72 pages) epicrisis. There are over 2,000 bibliographic references.

We can say with Dr. Mills in his able introduction that "in this wonderful collection of Dr. Southard is to be seen an epitome of war neurology not elsewhere to be found." The epicrisis is an interesting discussion of many phases of the subject. It is also inherently instructive. It abounds in sound direct and inferential advice to physician, government and army. No one can carefully read it, whether he agrees with the author or not, without acquiring a broad conception of war neuroses and their complications. If the physician has a broad conception of war neuroses, he has a fairly good grasp of peace psychoneuroses—a consummation devoutly to be wished. Furthermore, every intelligent reader will be interested in, instructed and entertained by the Southardian philosophic and linguistic agility.

However, it should be understood that in no sense is this work a textbook or systematic treatise. It is an exposition of many things, with a number of sage comments, wise admonitions and critical suggestions by a capable cicerone.

THE HYSTERIA OF LADY MACBETH. By ISADOR H. CORIAT, M.D. Moffat, Yard and Company, New York, 1912. Pp. 92.

This is an interesting little essay on Lady Macbeth. The book is apparently intended for the lay public, for in the first, second and third chapters there is an exposition of the general principles of psychanalysis and its reference to literature. In brief the author states that "Lady Macbeth is a typical case of hysteria; her ambition is merely a sublimation of a repressed sexual impulse, the desire for a child based on the memory of a child long since dead. In fact an analysis of the sleep-walking scene demonstrates that it is neither genuine sleep nor the pricklings of a guilty conscience, but a clear case of pathological somnambulism, a genuine disintegration of the personality."

According to the author, Macbeth was an epileptic, which explains one phase of his criminality. Coriat says that "the four great tragedies of Shakespeare have sexual problems as their central motive. The father problem appears in Lear and Hamlet, the evolution of a jealousy complex in Othello and the theme of childlessness in Macbeth." The author goes on to say that Shakespeare was not a scientist, but he was able intuitively to demonstrate the mental mechanism of his characters. Whatever the reader might think of this point of view, the book is interesting and worth reading.